FINAL PROJECT – TI 184833

FEASIBILITY STUDY OF PROPERTY BUSINESS DEVELOPMENT IN SIDOARJO DISTRICT USING SPATIAL ANALYSIS AND GEOGRAPHIC INFORMATION SYSTEM

MUHAMMAD ALAM PRADIPTA

NRP. 02411740000105

Supervisor:

Dr. Ir. I Ketut Gunarta, M.T.

NIP. 196802181993031002

DEPARTMENT OF INDUSTRIAL AND SYSTEM ENGINEERING

Faculty of Industrial Technology and Systems Engineering

Institut Teknologi Sepuluh Nopember

Surabaya

2021

FINAL PROJECT – TI 184833

FEASIBILITY STUDY OF PROPERTY BUSINESS DEVELOPMENT IN SIDOARJO DISTRICT USING SPATIAL ANALYSIS AND GEOGRAPHIC INFORMATION SYSTEM

MUHAMMAD ALAM PRADIPTA

NRP. 02411740000105

Supervisor:

Dr. Ir. I Ketut Gunarta, M.T.

NIP. 196802181993031002

DEPARTMENT OF INDUSTRIAL AND SYSTEM ENGINEERING

Faculty of Industrial Technology and Systems Engineering

Institut Teknologi Sepuluh Nopember

Surabaya

2021

(This page is intentionally left blank)

APPROVAL SHEET

FEASIBILITY STUDY OF PROPERTY BUSINESS DEVELOPMENT IN SIDOARJO DISTRICT USING SPATIAL ANALYSIS AND GEOGRAPHIC INFORMATION SYSTEM

FINAL PROJECT

Proposed to Fulfill the Requirement to Obtain
The Bachelor Degree of Engineering in
Bachelor Program of Industrial System and Engineering Department
Faculty of Industrial Technology and System Engineering
Institut Teknologi Sepuluh Nopember

Compiled by:
MUHAMMAD ALAM PRADIPTA
Student Number 02411740000105

Approved by:
Supervisor

Dr. Ir. I Ketut Gunarta, M.T.
NIP. 196802181993031002

Surabaya, August 2021

(This page is intentionally left blank)

FEASIBILITY STUDY OF PROPERTY BUSINESS DEVELOPMENT IN SIDOARJO DISTRICT USING SPATIAL ANALYSIS AND GEOGRAPHIC INFORMATION SYSTEM

Name	: Muhammad Alam Pradipta
Student ID	: 02411740000105
Supervisor	: Dr. Ir. I Ketut Gunarta, M.T.

ABSTRACT

Housing is one of the five basic human needs that every human must have. Currently, Sidoarjo District has the number of livable houses at 454,514 units while the number of households in Sidoarjo is 211,933 households. Those number leaves 242,581 households that do not live-in livable houses, which shows that the number of houses is still not meeting the needs of livable houses in Sidoarjo. PT. X as one of the housing development companies in Sidoarjo District, currently has four different lands across three sub-districts that can be built into housing. Before implementing the housing development project, the company needs to conduct several analyses which are market analysis, spatial analysis, and feasibility analysis. This research focuses on determining the best location alternative that will be built into housing development project. In determining potential demand using quadratic trend method, it can be concluded that the project is feasible since there are unmet demand of housing in Sidoarjo District. For the spatial analysis, the weighted overlay process using ArcGIS are done to determine the priority location based on six criteria parameters. From the result of spatial analysis, it was found that there is one location in Priority I which is Location 4, one location in Priority II which is Location 2, one location in Priority III, and one location in Priority V. Therefore, the Location 4 and Location 2 are selected to be calculated from the financial perspective using financial valuation parameters which are NPV and IRR. The result is both locations are feasible to be implemented according to the value of NPV and IRR from both locations. Then the sensitivity analysis is done to know the most significant parameter that affect the feasibility of each location. From the result of both location alternatives sensitivity analysis, it can be concluded that land price has the most significant impact to the overall impact of the financial model and feasibility analysis.

Key Words: Housing Development, Market Analysis, Spatial Analyst, Geographical Information System, Financial Modelling, Feasibility Study

(*This page is intentionally left blank)*

ACKNOWLEDGEMENT

Praise to Allah SWT., whom by His blessings this research with the title of "Feasibility Study of Property Business Development in Sidoarjo District Using Spatial Analysis and Geographic Information System" can be completed in time. This research is done as a requirement to complete Industrial System and Engineering Undergraduate Degree (S1) in Department of Industrial System and Engineering in the Faculty of Industrial Technology and System Engineering at Institut Teknologi Sepuluh Nopember, Surabaya.

During the process of completing this research, the authors has received many guidance, support, and suggestions from many people. In this opportunity, the author would like to express author's gratitude to:

1. Dr. Ir. I Ketut Gunarta, M.T., as the supervisor of this research, for all his guidance, knowledge, suggestion, and support for the author,
2. Putu Dana Karningsih ST, M. Eng. Sc, Ph.D., Dr. Ir. Sri Gunani Partiwi M.T., and Dr. Ir. Bambang Syairudin, M.T. as the examiner of this research, for all suggestions and corrections for the author's work,
3. Nurhadi Siswanto, S.T., M.S.I.E, Ph.D., as the Head of Department of Industrial System and Engineering of ITS, for all inspiration given to the author,
4. All respectful and distinguished lecturers of Department of Industrial System and Engineering of ITS, for all lessons, knowledge, and experience given to the author during author's study,
5. Author's beloved family, Mardhiyah Hayati, Waluyo Edi Susanto, and Bulan Rahma Nindita, for the endless love, prayer, moral and material supports for the author,
6. All of the author's companions, especially Qutbudin, Vian, Annura, Mas Bimo, Benhard, Rizaldy, Diba, and many more that the author cannot mention one by one, for the motivation, inspiration, and moral support for the author.
7. Author's colleagues at PSMI Laboratory, for the support and insights for the author during his study.

8. All author's friends and colleague in Department of Industrial System and Engineering of ITS,

Last, for everyone that indirectly contributed to the completion of author's work, may Allah bless us with all His grace. In the completion of this research, author realizes that there are still many rooms to develop in this research as this work is far from being perfect. Therefore, author expects critics and suggestions from the readers so that this research can be developed further and give a bigger benefit for us all. May this research be useful for all readers.

Surabaya, July 2021

Author

TABLE OF CONTENTS

APPROVAL SHEET v

ABSTRACT vii

ACKNOWLEDGEMENT ix

TABLE OF CONTENTS 1

LIST OF TABLES 5

LIST OF FIGURES 7

CHAPTER 1 INTRODUCTION 9

1.1 Background 9

1.2 Problems Formulation 14

1.3 Research Objectives 14

1.4 Research Benefits 14

1.5 Research Scopes 15

1.5.1 Limitations 15

1.5.2 Assumptions 15

1.6 Report Writing Systematics 16

CHAPTER 2 LITERATURE REVIEW 19

2.1 House 19

2.1.1 House Function 19

2.1.2 Type of House 20

2.2 Housing 21

2.2.1 Housing Developer 23

2.3 Income Recognition Accounting in Property Companies 24

2.4 Market Analysis 26

2.5 Forecasting 28

2.5.1 Types of Forecasting 28
2.5.2 Forecasting Methods 29
2.6 Analytical Hierarchy Process (AHP) 32
2.7 Spatial Analysis 35
2.8 Geographic Information System (GIS) 39
2.9 Financial Modelling 42
2.9.1 Financial Projection Model 43
2.9.2 Discounted Cash Flow (DCF) 44
2.9.3 Free Cash Flow (FCF) 45
2.9.4 Cost of Capital 45
2.9.5 Depreciation and Amortization 47
2.9.6 Inflation 48
2.10 Financial Feasibility Parameters for Alternative Selection 48
2.10.1 Net Present Value (NPV) 48
2.10.2 Internal Rate of Return (IRR) 49
2.10.3 Payback Period 49
2.11 Sensitivity Analysis 51
CHAPTER 3 RESEARCH METHODOLOGY 53
3.1 Flowchart of Research Methodology 53
3.2 Description of Research Methodology 55
3.2.1 Data Collection Phase 55
3.2.2 Data Processing Phase 56
3.2.3 Data Analysis and Interpretation Phase 59
3.2.4 Drawing Conclusion and Suggestion Phase 59
CHAPTER 4 MARKET ANALYSIS 61
4.1 Data Collection 61

4.1.1 Household Data of Sidoarjo District 61
4.1.2 House Data of Sidoarjo District 62
4.2 Demand Forecasting 64
4.2.1 Linear Trend Method 64
4.2.2 Exponential Trend Method 65
4.2.3 Quadratic Trend Method 67
4.2.4 S-Curve Logistic Method 68
4.2.5 Potential Demand 69
4.3 Analysis of Market 70
CHAPTER 5 SPATIAL ANALYSIS 73
5.1 General Description of PT. X Existing Condition 73
5.2 Identification of Criterias Used for Location Analysis 73
5.3 Criteria Weighting Using AHP Method 78
5.4 Map Digitation 80
5.4.1 Main Road 80
5.4.2 Land Slope 81
5.4.3 Electric Grid 82
5.4.4 Health Facilities 83
5.4.5 Educational Facility 84
5.4.6 Spatial Patterns 84
5.4.7 Final Map 85
5.5 Spatial Analysis Using GIS 86
5.6 Analysis of Priority Location 96
CHAPTER 6 FEASIBILITY ANALYSIS 98
6.1 Data Collection 98
6.1.1 Inflation 98

6.1.2 Planning Horizon Determination 98
6.1.3 WACC Calculation 99
6.1.4 Financial Model Micro and Macro Assumption Determination ... 102
6.2 Data Processing 104
6.2.1 Business Plan of Property Business Development 104
6.2.2 Financial Modelling and Feasibility Analysis 113
6.2.3 Sensitivity Analysis 135
6.3 Analysis and Interpretation 139
6.3.1 Analysis of Feasibility Result 139
6.3.2 Sensitivity Analysis of Feasibility Result 141
CHAPTER 7 CONCLUSIONS AND SUGGESTIONS 144
7.1 Conclusions 144
7.2 Suggestions 145
REFERENCES 148
LIST OF ATTACHMENTS 152

LIST OF TABLES

Table 4. 1 Household Data of Sidoarjo District 61
Table 4. 2 House Development Realization in Sidoarjo District of 1990-2010 ... 63
Table 4. 3 Forecast Result using Linear Trend Method 64
Table 4. 4 Forecast Result using Exponential Trend Method 66
Table 4. 5 Forecast Result using Quadratic Trend Method 67
Table 4. 6 Forecast Result using S-Curve Logistic Method 68
Table 4. 7 MAPE and MAD Recapitulation 70
Table 4. 8 Potential Demand for 2021-2025 70
Table 4. 9 Unmet Demand of House Projection 72
Table 5. 1 Administrative Data of Sub-Districts in Sidoarjo District 74
Table 5. 2 Criterias of Priority Location Determination 76
Table 5. 3 Criteria characteristics 77
Table 5. 4 AHP Assessment of Criterias 78
Table 5. 5 Influence of Each Criteria Parameters 79
Table 5. 6 Class Division of Buffer Area 89
Table 5. 7 Input Recapitulation for Weighted Overlay Tool 92
Table 5. 8 Priority Area Value 96
Table 5. 9 Area of Each Priority 97
Table 5. 10 Micro Assumption of Financial Model 102
Table 6. 1 Components Variables of WACC 99
Table 6. 2 Macro Assumption of Financial Model 102
Table 6. 3 CAPEX Schedule for Location 4 107
Table 6. 4 CAPEX Recapitulation for Location 4 107
Table 6. 5 Total OPEX/Year for Location 4 (in IDR, million) 109
Table 6. 6 CAPEX Schedule of Location 2 111
Table 6. 7 CAPEX Recapitulation for Location 2 112
Table 6. 8 Total OPEX/Year for Location 2 113
Table 6. 9 Location 4 - Debt to Equity Ratio 114
Table 6. 10 Location 4 - Loan Drawdown 114
Table 6. 11 Location 4 - Debt Repayment Schedule (in million) 115

Table 6. 12 Location 4 - Interest Expense 116
Table 6. 13 Location 4 - Sales and Construction Schedule 116
Table 6. 14 Location 4 - Sales Recapitulation 117
Table 6. 15 Location 4 - Income Recognition (in million Rupiah) 118
Table 6. 16 Location 4 - Sales Advance (in million Rupiah) 120
Table 6. 17 Location 4 - Prepaid Expenses (in million Rupiah) 120
Table 6. 18 Location 4 - Income Statement (in million Rupiah) 121
Table 6. 19 Location 4 – Cash Flow Statement (in million rupiah) 122
Table 6. 20 Location 4 - Balance Sheet (in million rupiah) 123
Table 6. 21 Location 4 - Free Cash Flow Projection (in million rupiah) 124
Table 6. 22 Location 4 - Valuation Result 125
Table 6. 23 Location 2 - Funding 125
Table 6. 24 Location 2 - Loan Drawdown 125
Table 6. 25 Location 2 - Debt Repayment Schedule (in million rupiah) 126
Table 6. 26 Location 2 - Interest Expense 126
Table 6. 27 Sales and Construction Schedule 127
Table 6. 28 Location 2 - Sales Recapitulation 128
Table 6. 29 Location 2 - Income Recognition (in million rupiah) 129
Table 6. 30 Location 2 - Sales Advances (in million rupiah) 130
Table 6. 31 Location 2 - Prepaid Expenses (in million rupiah) 130
Table 6. 32 Location 2 - Income Statement (in million rupiah) 131
Table 6. 33 Location 2 - Cash Flow Statement 132
Table 6. 34 Location 2 - Balance Sheet (in million rupiah) 133
Table 6. 35 Location 2 - Free Cash Flow (in million rupiah) 134
Table 6. 36 Location 2 - Valuation Result 135
Table 6. 37 Location 4 - Land Price Sensitivity Result 136
Table 6. 38 Location 4 - Construction Cost Sensitivity Result 137
Table 6. 39 Location 2 - Land Price Sensitivity Result 138
Table 6. 40 Location 2 - Construction Cost Sensitivity Result 138

LIST OF FIGURES

Figure 1. 1 Sidoarjo District Population Data 9
Figure 1. 2 Sidoarjo District Household Data 10
Figure 1. 3 PT. X Projects in Jawa Timur 11
Figure 1. 4 Projects Land of PT. X in Sidoarjo District 12
Figure 1. 5 Map of Spatial Plan for Sidoarjo District 13
Figure 2. 1 Comparison Matrix of The First Node 32
Figure 2. 2 Numerical scale 33
Figure 2. 3 Verbal scale 33
Figure 2. 4 Graphical scale 33
Figure 2. 5 Derive New Information from Existing Data 36
Figure 2. 6 Identifying suitable locations 36
Figure 2. 7 Distance and cost-of-travel analysis 37
Figure 2. 8 Identify corridors or best paths between locations 37
Figure 2. 9 Zonal calculations, such as the average slope of the landform per watershed 38
Figure 2. 10 Interpolating point sample data to a continuous raster surface 38
Figure 2. 11 Generalizing an input raster 39
Figure 2. 12 Relation of Financial Statements 44
Figure 3. 1 Research Methodology Flowchart 53
Figure 3. 2 Research Methodology Flowchart (Con't) 54
Figure 3. 3 Research Methodology Flowchart (Con’t) 55
Figure 4. 1 Linear Trend Analysis Plot 65
Figure 4. 2 Exponential Trend Analysis Plot 66
Figure 4. 3 Quadratic Trend Analysis Plot 68
Figure 4. 4 S-Curve Trend Analysis Plot 69
Figure 5. 5 Administrative Digital Map of Sidoarjo District 75
Figure 5. 6 AHP Consolidated Result 79
Figure 5. 7 Digital Map of Main Road in Sidoarjo District 81
Figure 5. 8 Digital Map of Land Slope in Sidoarjo District 82
Figure 5. 9 Digital Map of Electric Grid in Sidoarjo District 83

Figure 5. 10 Digital Map of Health Facilities in Sidoarjo District 83
Figure 5. 11 Digital Map of Educational Facilities in Sidoarjo District 84
Figure 5. 12 Digital Map of Sidoarjo District Spatial Pattern 85
Figure 5. 13 Digital Map of Criteria Parameters in Sidoarjo District 85
Figure 5. 14 Model Builder 86
Figure 5. 15 Model Builder (Con't) 86
Figure 5. 16 Dialog box of Euclidean Distance Tool in ArcGIS 87
Figure 5. 17 Euclidean Distance Result of Main Road 88
Figure 5. 18 Reclassify Tool in ArcGIS 89
Figure 5. 19 Dialog Box of Reclassify Tool on ArcGIS 90
Figure 5. 20 Dialog Box of Class Division on Reclassify Tool 91
Figure 5. 21 Weighted Overlay Tools in ArcGIS 92
Figure 5. 22 Dialog Box of Extract by Mast Tool on ArcGIS 95
Figure 5. 23 Weighted Map of Priority Location 95

CHAPTER 1
INTRODUCTION

In this chapter, there will be an information about the basic things related to the research done by the author including research background, problems formulation, objectives, benefits, scopes, and its report writing systematic.

1.1 Background

Sidoarjo District is a district in East Java Province, Indonesia. Sidoarjo District is bordered by Surabaya City and Gresik District in the north, Madura Strait in the east, Pasuruan District in the south, and Mojokerto District in the west. This district with an area of 714.24 km^2 is one part of an area called Gerbangkertosusila (Gresik, Bangkalan, Mojokerto, Surabaya, Sidoarjo, and Lamongan), which is a metropolitan area with the city of Surabaya as the center.

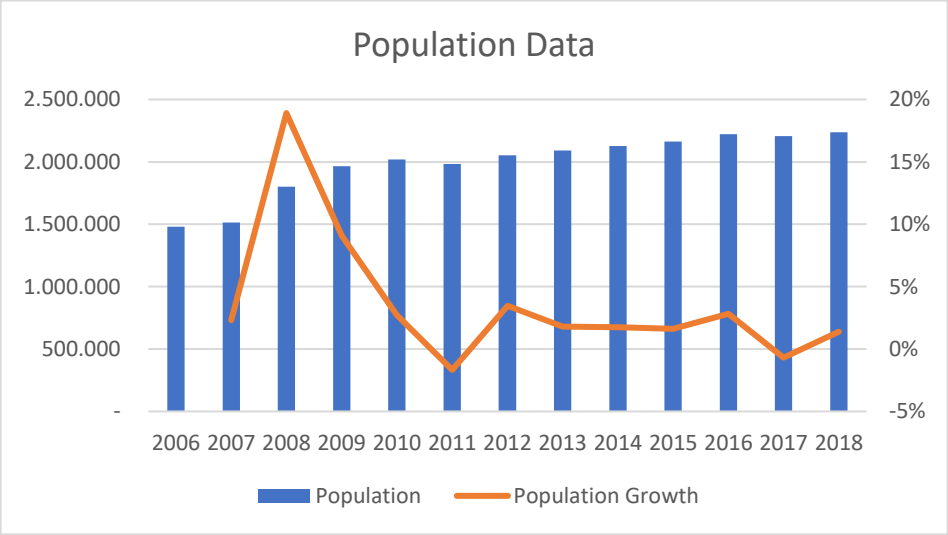


Figure 1. 1 Sidoarjo District Population Data
(Source: BAPPEDA of Sidoarjo District)

Sidoarjo District is a district with densely populated population with a population density of 2,750 people per square kilometer. From 2006 to 2018, Sidoarjo District has experienced an average population growth of 3.63%. This figure is far above the average population growth rate in East Java in the 2010-2019

period of 0.62% and is still higher than the national average growth rate of 1.31%. Thus, meeting the primary needs of the population must be the focus of the government to balance the population growth rate in Sidoarjo District.

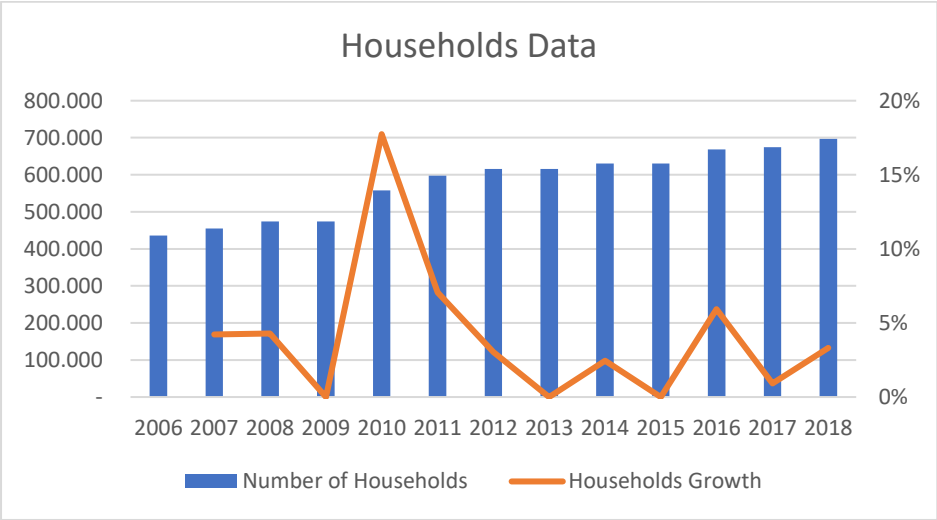


Figure 1. 2 Sidoarjo District Household Data

(Source: BAPPEDA of Sidoarjo District)

The International Labor Organization defines primary needs as five basic human needs that people has in developing countries. Those five needs are food, clothing, housing, education, and public transportation. Based on Law Number (No). 1 of 2011, a house is a building that functions as a habitable place to live, a means of fostering a family, a reflection of the dignity of its inhabitants, as well as an asset for its owner. As the population grows, the number of households will also increase. As can be seen in figure 1.2, from 2006 to 2018, Sidoarjo District experienced an average household growth of 4.08%. Ideally, every household should have at least one house to live in. Therefore, the construction of houses and housing is important in meeting the primary needs of the community.

Based on data published by the Bappeda of Sidoarjo District, the number of livable houses in the Sidoarjo District in 2017 was recorded at 434,843 units spread across 18 sub-districts. This number increased by 4.52% in 2018 to 454,514 units spread across 18 sub-districts. Those data shows that in 2018, there are 242,581 households that do not possess or live in livable houses. This problem shows that the number of houses are still not meeting the needs of livable houses in Sidoarjo.

Therefore, housing construction has become an important issue for Sidoarjo District government to solve.

The construction of housing can be done by government or housing developer. Based on Regulation of the Minister of Home Affairs Number (No). 5 Article 5 of 1974, A housing development company is a company that engages in the field of housing construction of various types in large numbers on a land area which will be a residential neighborhood unit equipped with environmental infrastructure and social facilities required by the resident community. One of the housing developers in Sidoarjo District is PT. X. PT. X is one of the successful developers in providing *Rumah Sederhana Sehat* (RSH). Until now, PT. X has built eleven projects spread across four cities which are Malang, Pasuruan, Surabaya, and Sidoarjo. The projects of PT X in those cities can be seen in Figure 1.3. Currently, PT. X has four different lands across three sub-districts in Sidoarjo District that can be built into housing. Those lands are located in Balongbendo sub-district, Prambon sub-district, and Tanggulangin sub-district as shown in Figure 1.4. Those location will be used as the location alternatives in this research.

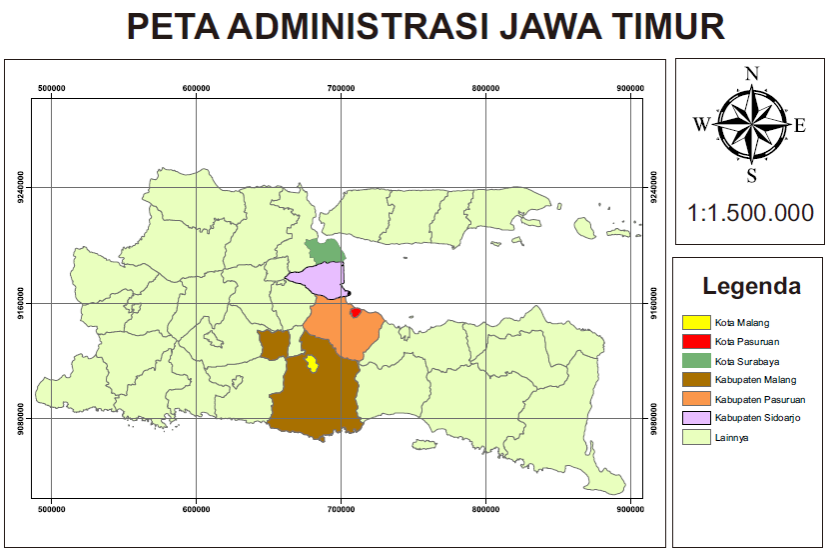


Figure 1. 3 PT. X Projects in Jawa Timur

(Source: Author's document)

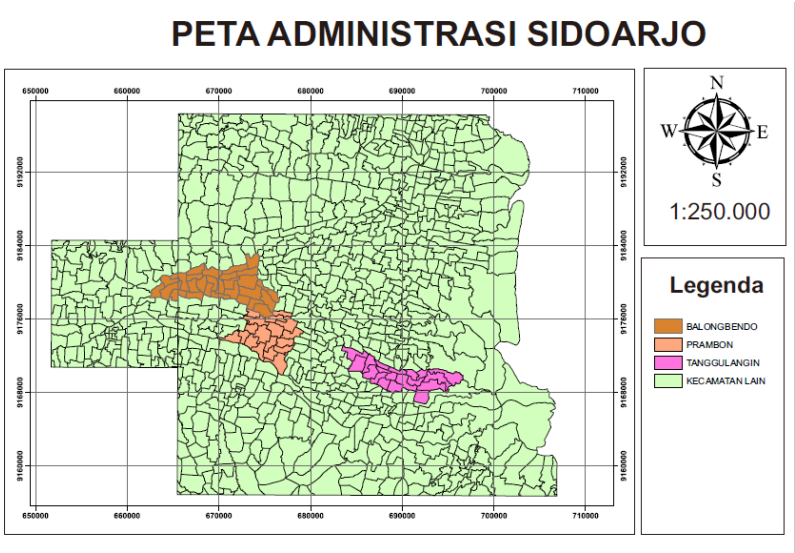


Figure 1. 4 Projects Land of PT. X in Sidoarjo District

(Source: Author's document)

Along with the increasing demand for houses, housing developers are growing rapidly in cities to support the provision of housing needs on a mass scale. Therefore, the term 'housing market' emerged, which denotes opportunities for profit in the provision of housing. With the increase in the housing market, the prices of various components of housing development have also increased, such as land prices and building materials. This causes housing development in Indonesia to focus more on medium and luxury houses. This causes housing development not only to be seen from its social function but also its economic function. Therefore, the government is concerned about the balance of housing fulfillment from social and economic functions as outlined in the Decree of the state minister for Public Housing Number 04 / KPTS / BKP4N / 1995, which requires that housing developers must build housing with a ratio of the large, medium, large housing. and simple is 1: 3: 6. This directive requires that housing developers should not only prioritize obtaining profits through the construction of luxury houses but still consider the social function by building more simple houses. Therefore, the developer and the government acting as producers must be able to satisfy market demand so that there is a match between supply and demand. For that, a market analysis is needed that can identify the suitability of supply and demand.

In the technical guidelines Pd T-03-2005-C concerning Procedures for Selection of Priority Locations for Housing and Settlement Development in Urban Areas by the Ministry of Public Works, there are general requirements for housing and settlement locations. The location of the residential area must be following the land use plan stipulated in the local Regional Spatial Plan or other spatial planning documents determined by the local Regional Regulation, or meet the following requirements: (a) Not in a protected area; (b) Free from water, air, and sound, or other disturbances, whether man-made or natural resources such as floods, landslides, tsunamis; (c) The elevation of the land is less than 1,000 meters above sea level; (d) Land slope less than 15%; (e) In cities that have airports, do not interfere with the flight path of the aircraft; (f) The condition of the infrastructure is adequate; (g) Close to the activity and service centers of the city; (h) For lower-middle-income people, the linkage between housing locations and activity centers (workplaces) and city services will have economic implications.

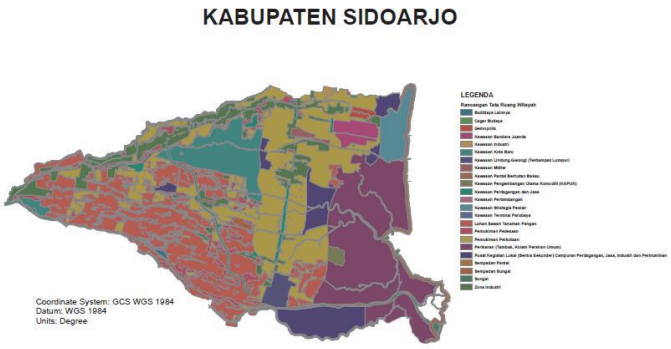


Figure 1. 5 Map of Spatial Plan for Sidoarjo District
(Source: BAPPEDA of Sidoarjo District)

Taking into account the problems mentioned in the preceding paragraphs, PT X as a housing development company must carry out a market analysis to identify the suitability of housing demand and supply. In addition, in housing development planning, it is also necessary to select priority locations using a spatial analysis approach to provide scoring of each alternative land owned by PT X. The use of spatial analysis in determining location priorities is necessary because of the level of complexity of the requirements indicators in this study such as the use or

function of each particular area that has been planned by the government in figure 1.5, as well as other requirements mentioned in the previous paragraph. The use of Geographical Information Systems combined with spatial analysis will create an understanding of determining the location of housing by considering certain indicators in one map to make the research process more efficient and effective in solving the land determination problem of PT. X. Aside from the market analysis and location determination, PT. X also need to determine all implied costs, in terms of investment and operational expenses, that needs to be considered before implementing the project. They also need to consider the volatility of current condition. Hence, this research will consist the process of the feasibility study of the project.

1.2 Problems Formulation

According to the problem that has been identified in the background, the formulated problem that will be the focus of this research is about how to determine the feasibility and land priorities that are suitable for property development in the Sidoarjo District.

1.3 Research Objectives

The objectives of this final project research are:

1. Identify potential market of property in Sidoarjo District.
2. Determine the priority location for the property business development.
3. Develop a financial projection and determine the feasibility of property development in Sidoarjo District.
4. Conduct a sensitivity analysis of important parameters that determines the feasibility of property development in Sidoarjo District.

1.4 Research Benefits

The benefits of this final project research are differentiated into two types which are benefits for PT. X, and for the author. The benefits for PT X are:

1. Facilitates the market analysis of the housing development in Sidoarjo District for PT. X.

2. Facilitates the priority location determination of vacant land for housing development.
3. Facilitates decision making process on determining the feasibility of property development to be implemented by PT. X
4. PT. X can make housing development plans following applicable government regulations.

The benefits for the author are:

1. As an opportunity for the author to hone author's problem-solving skill to come with a systematic way to solve a case faced by PT. X.
2. As an opportunity for the author to implement industrial engineering science in a case faced by PT. X.

1.5 Research Scopes

The scopes of this final project research include several lists of limitations and assumptions used in this research.

1.5.1 Limitations

The limitations used in this final project research are:

1. District Spatial Patterns are following the data from the Sidoarjo District Government.
2. Location alternatives are already determined by the company.
3. This research does not consider the COVID-19 pandemic condition.

1.5.2 Assumptions

The assumptions used in this final project research are:

1. Inflation rate projection used in the time horizon of financial modelling of this research assumed to be flat and follow Bank Indonesia inflation rate target in 2021 which is 3%.
2. Income and expense with no specific implied growth rate is assumed to have growth rate equal to inflation.
3. There are no changes in the spatial patterns data collected.

1.6 Report Writing Systematics

This research report systematics will briefly explain about each part of all six chapters included in this report.

CHAPTER 1 INTRODUCTION

This chapter will consist of information about the basic things related to the research done by the author including research background, problems formulation, objectives, benefits, scopes, and its report writing systematic.

CHAPTER 2 LITERATURE REVIEW

This chapter will consist of information about basic theories that will be used by the author as the reference for doing this research. These basic theories include house, housing, market analysis, facility planning, Analytical Hierarchy Process (AHP), spatial analysis, Geographic Information System (GIS).

CHAPTER 3 RESEARCH METHODOLOGY

This chapter will consist of information about the steps that will be done by the author in conducting this research including problems identification and formulation, data collection, data processing, data analysis and interpretation, and drawing conclusions and suggestions.

CHAPTER 4 MARKET ANALYSIS

This chapter will consist of information about data collection and processing steps that will be done by the author in doing market analysis of the housing market in Sidoarjo District. After the data collection and processing steps are done, the data analysis and interpretation are also done in this chapter regarding the market analysis.

CHAPTER 5 SPATIAL ANALYSIS

This chapter will consist of information about data collection and processing steps that will be done by the author in doing the priority location determination using spatial analysis based on Geographic Information System. After the data collection and processing steps are done, the data analysis and interpretation are also done in this chapter regarding the priority location determination.

CHAPTER 6 FEASIBILITY ANALYSIS

This chapter will consist of information about data collection and processing steps that will be done by the author in doing feasibility analysis of the property

business development. After the data collection and processing steps are done, the data analysis and interpretation are also done in this chapter regarding the feasibility analysis.

CHAPTER 7 CONCLUSIONS AND SUGGESTIONS

This chapter will consist of information about conclusions that can be drawn by the author from this research according to the research objectives which already has been stated before and suggestions from the authors for improvement on further research development.

(This page is intentionally left blank)

CHAPTER 2
LITERATURE REVIEW

In this chapter, there will be an information about the basic theories that will be used by the author as the reference for doing this research.

2.1 House

Based on Law Number (No). 1 of 2011, house is a building that functions as a habitable place to live, a means of fostering a family, a reflection of the dignity of its inhabitants, as well as an asset for its owner. In a broad sense, a house is not only a structural building, but also a place of residence that meets the requirements of a decent life, seen from various aspects of community life (Frick & Mulyani, 2006). As a building, a house is in the form of a room bordered by walls and roofs. A house has an entrance in the form of a door with additional windows. The floor of the house is usually in the form of soil, tiles, rats, ceramics, or other materials. The room in the house is divided into several rooms that function specifically, such as: bedroom, bathroom, toilet, dining room, kitchen, family room, living room, garage, warehouse, terrace, and yard.

2.1.1 House Function

Broadly speaking, house has four main functions as a proper place to live for every human being, namely:

1. A house must meet the basic human needs.
2. A house must meet the basic spiritual needs of humans.
3. A house must protect humans from disease transmission.
4. A house must protect humans from outside disturbances.

The definition of a house that can satisfy basic human needs is a house that meets the following requirements:

1. May provide protection against weather disturbances or climatic conditions that are not suitable for human living conditions. For example, heat, cold, wind, and rain.

2. Can meet the needs of its residents to carry out activities or daily household chores.

A home that can meet people's spiritual needs is a home that gives a feeling of security and peace to the whole family so that they can come together and live together, and can develop healthy traits and personalities. A house that is a place of protection from the influence of the outside environment is a house that can keep all health problems away for its occupants. The house must also be strong and stable so that it can protect against security disturbances caused by natural disasters or riots or crimes by theft and robbery (Frick & Mulyani, 2006).

2.1.2 Type of House

According to Sastra and Marlina (2006), types of houses can be classified as follows:

1. Simple House

A simple house is a small type house, which has limitations in spatial planning. This type of house is perfect for small families and people with low purchasing power. Simple houses are part of the government housing subsidy program to provide decent and affordable housing for people with low income or purchasing power. In general, a simple house has a house area of 22 m^2 to 36 m^2, with a land area of 60 m^2 to 75 m^2.

2. Medium House

In this type, there is quite a lot of space that can be planned and space planning is more flexible than in a simple house. In general, this medium-sized house has a house area of 45 m^2 to 120 m^2, with a land area of 80 m^2 to 200 m^2.

3. Luxury House

A luxury house is a large type of house, usually owned by people with high income and purchasing power. Space planning in this type of house is more complex because the space requirements that can be planned in this house are many and adjusted to the needs of the owner. This large type of house is generally not only used for residence but also as a status symbol, a symbol of the personality and character of the homeowner, or a symbol of prestige. In general, these luxury homes

usually have a house area of more than 120 m^2 with a land area of more than 200 m^2.

2.2 Housing

According to Law Number (No). 1 of 2011, Housing is a collection of houses as part of a settlement, both urban and rural, which are equipped with infrastructure, facilities, and public utilities as a result of efforts to fulfill a livable house. Physically, housing is an environment consisting of a collection of residential units where social interaction is possible among its residents and is equipped with social, economic, cultural, and service infrastructure which are a subsystem of the city as a whole. This environment usually has rules, habits, and value systems that apply to its citizens.

In making a housing plan that can truly answer the demands of housing and settlement development, it is necessary to consider planning aspects (Sastra & Marlina, 2006). Aspects that underlie housing planning include:

1. Environment

Things that must be considered in housing planning are good and directed environmental management because the environment or housing is a very determining factor and its existence should not be ignored. This can happen because the good and bad environmental conditions will have an impact on residential residents.

2. Affordability

Building planning is expected to support the achievement of development goals that have been declared by the program. Several factors that can affect people's purchasing power include:

a. Per capita income of the majority of the population is still relatively low
b. The education level of some people, especially in rural areas, is still relatively low
c. uneven development in various regions, which triggers social and economic disparities, where this has an impact on competition between high-income groups and low-income people as if the facilities and progress of development can only be enjoyed by high-income people.

d. The political and security situation tends to be unstable, which affects people's interest and purchasing power to invest and develop capital

High inflation causes the price of building materials to rise, which results in soaring house prices, both for the simple, medium, and luxury housing categories.

3. Institutional

The success of housing development in an area, both in urban and rural areas, cannot be separated from the role of the government as the party that is obliged to direct, guide, and create an atmosphere conducive to the creation of this success. The community as the main actor of development plays an important role in every development program that is carried out.

According to Law Number (No.) 1 of 2011 about Housing and Settlement Areas, housing and housing management can be carried out by:

1. The government and/or local governments for example in the form of housing organized by Perum PERUMNAS, Special Housing for Civil Servants, and so on.
2. The private sector or individual housing developers or companies with legal status.
3. Nongovernmental

Based on SNI 03-1733-2004 (2004) regarding the planning procedures for housing environments in urban areas, the location of housing must meet the following conditions:

1. The location of housing must be by the land use plan stipulated in the local Spatial Planning (RTRW) or other planning documents stipulated by the local Regional Regulation, with the following criteria:
    a. Safety criteria, achieved by considering that the location is not a protected area (catchment area), agricultural processing, production forest, factory waste disposal area, a building-free area in the airport area, and areas under high voltage electricity network,
    b. Health criteria, achieved by considering that the location is not an area that has air pollution above the threshold level, surface water pollution, and deep groundwater.

c. Comfort criteria, achieved by easy achievement (accessibility), then communication (internal/external, direct or indirect), ease of doing activities (environmental infrastructure and facilities are available),
d. The criteria for beauty/compatibility/regularity (compatibility) are achieved by greening, maintaining existing topographic and environmental characteristics, for example not leveling hills, filling all swamps or lakes or rivers, and so on,
e. The criteria for flexibility, achieved by considering the possibility of physical growth/expansion of the housing environment associated with the physical condition of the environment and integration of infrastructure,
f. The criteria for the affordability of the distance are achieved by considering the ideal distance to achieve the ability of people to walk as environmental users to the placement of environmental utility facilities and infrastructure,
g. Environmental criteria with identity are achieved by considering the relationship with the socio-cultural character of the local community, especially the contextual aspect of the local traditional/local environment.

2. The location of the housing plan must be on land with clear ownership status and meet administrative, technical, and ecological requirements.
3. Integrity between the arrangement of activities and the nature around it, taking into account the type, growth period and age attained, as well as its impact on the environment, for existing and possibly growing plants in the area in question.

2.2.1 Housing Developer

Based on Regulation of the Minister of Home Affairs Number (No). 5 Article 5 of 1974, A housing development company is a company that engages in the field of housing construction of various types in large numbers on a land area which will be a residential neighborhood unit equipped with environmental infrastructure and social facilities required by the resident community.

The obligations that must be fulfilled by the developer in developing housing, namely:

1. Ratio of built area to open area of 60:40.

In building housing, the developer must divide the designated area and open area, where the total occupancy area is 60% and the open area designated for roads and open spaces is 40%.

2. The developer must provide housing infrastructure, facilities, and utilities following the classification of built housing.
3. The developer must have permission for the project to be built.

(Purnomo, et al., 2011)

In the technical guidelines Pd T-03-2005-C concerning Procedures for Selection of Priority Locations for Housing and Settlement Development in Urban Areas by the Ministry of Public Works, there are general requirements for housing and settlement locations. The location of the residential area must be following the land use plan stipulated in the local Regional Spatial Plan or other spatial planning documents determined by the local Regional Regulation, or meet the following requirements:

a. Not in a protected area;
b. Free from water, air, and sound, or other disturbances, whether man-made or natural resources such as floods, landslides, tsunamis;
c. The elevation of the land is less than 1,000 meters above sea level;
d. Land slope less than 15%;
e. In cities that have airports, do not interfere with the flight path of the aircraft;
f. The condition of the infrastructure is adequate;
g. Close to the activity and service centers of the city;
h. For lower-middle-income people, the linkage between housing locations and activity centers (workplaces) and city services will have economic implications.

2.3 Income Recognition Accounting in Property Companies

Income is an important element in the company's financial statements. According to the *Pernyataan Standar Akuntansi Keuangan* (PSAK) No.23

concerning Income, it is explained that what is meant by income is: gross inflows come from economic benefits arising from the normal activities of a company during a period when these inflows result in an increase in equity, which does not originate from investment contributions (Zuhriyah, et al., 2019).

A company engaged in the real estate sector whose main activity is the acquisition of land which is then followed up with housing construction to be sold to the public. The journey and development of a company is strongly influenced by the income earned in the normal operation of the business and the effort and power of the company to keep costs as small as possible without disrupting the company's business activities. Therefore, income can be said to be a measure of management achievement for the success and failure of a company.

Pernyataan Standar Akuntansi Keuangan (PSAK) No. 44 concerning Real Estate Development Activities are activities resulting from the acquisition of land for later construction of housing and/or commercial buildings and/or industrial buildings. Several types of companies, one of which is a company engaged in real estate or housing development, in which the process of implementing the construction of a housing complex can be completed by requiring more than one accounting period. In the statement also stated that the methods used to recognize income on the sale of houses, shophouses, and other similar buildings along with their land lots and the sale of land lots without buildings are the full accrual method and the deposit method.

a. Full Accrual Method

   Income from sales of shop-houses, houses, and other similar buildings and lots of lands are recognized under the full accrual method if all of the following criteria are met:

   1. The sales process has been completed;
   2. The selling price is collectible;
   3. The seller's invoice will not be subordinated in the future to other loans that will be obtained by the buyer;
   4. The seller has controlled the risks and benefits of ownership of the building unit to the buyer through a type of transaction in which in

substance, namely the sale and the seller is no longer obliged or significantly involved with the building unit.

b. Deposit Method

If a real estate transaction does not meet the criteria for profit recognition using the full accrual method, recognition of the sale is deferred and the transaction will be recognized using the deposit method until all the criteria using the full accrual method are met. The application of the deposit method is as follows:

1. The seller does not recognize income from the sale of real estate transactions, and the receipt of payment by the buyer is recorded as an advance;
2. Receivables from the sale of a real estate unit are not recognized;
3. The real estate unit is still recorded as the seller's asset, as well as the liabilities associated with the real estate unit, even though the obligation has been transferred to the buyer;
4. Specifically for real estate units, the depreciation in the real estate unit is still recognized by the seller.

If in practice the criteria in the full accrual method have not been met, revenue recognition will be deferred until all criteria are met, the company recognizes it as an advance for the transaction. Therefore, the use of the accrual method or recognizing income directly when receiving advances has not been implemented by the company.

2.4 Market Analysis

Market demand for a product is the total amount to be purchased by a certain group of consumers in a certain area in a certain marketing environment and a particular marketing program (Kotler & Keller, 2009). The purpose of conducting a market analysis is to find out how vast the market for the product is, how the demand is, and how much can the companies can fulfill.

The market is a meeting place between sellers and buyers and the forces of supply and demand meet to form a price (Umar, 2005). Market conditions are

affected by three main factors, namely various consumer desires, purchasing power, and consumer behavior.

Market analysis can be done qualitatively, namely by identifying, separating, and making market descriptions. Market analysis also can be done in a quantitative way, such as calculating the estimated sales of products in the future period. Market analysis can include:

a. Market description
b. Demand analysis
c. Supply analysis
d. Estimated future demand for the product
e. Market share estimation

(Umar, 2005)

The market includes all individuals and organizations that are tangible or potential consumers of a product including end consumers, industry, intermediaries, and government. Market measurement is an attempt to estimate product demand quantitatively, including:

a. Market demand covers geographic areas. The consumer group in a certain period is an attempt to define the market and market segmentation so that the marketing mix is different. Several market segmentations approach according to Kotler and Keller (2009), namely:
    1. Segmentation based on geography, for example by country, province, district, sub-district, etc.
    2. Segmentation based on demographics, for example by age, gender, occupation, religion, etc.
    3. Segmentation based on psychographics, for example by social class, lifestyle, personality, etc.
    4. Segmentation based on behavior, for example based on knowledge, attitudes, uses, etc.
b. Market share and market growth patterns must pay attention to several conditions, namely:
    1. Price competition and market growth
    2. Forecast of future demand

3. Assess market feasibility
4. Designing a marketing strategy with a marketing mix (4P)

In this research, market analysis will be done to assess the feasibility of the housing development which is conducted by PT. X.

2.5 Forecasting

Forecasting is the art and science of predicting future events. Forecasting may involve taking historical data and projecting them into the future with some sort of mathematical model. It may be a subjective or intuitive prediction. Or it may involve a combination of mathematical model adjusted by an expert judgement (Heizer & Render, 2011).

Heizer and Render (2011) also stated that forecasting follows seven basic steps, namely:

1. Determining the use of the forecast;
2. Selecting the items to be forecasted;
3. Determining the time horizon of the forecast;
4. Selecting the forecasting model(s);
5. Gathering the data needed to make the forecast;
6. Making the forecast;
7. Validating and implementing the results.

2.5.1 Types of Forecasting

A forecast is usually classified by the future time horizon that it covers. Time horizons are divided into three categories:

1. Short-range forecast; generally, spans less than 3 months. Used for planning purchasing, job scheduling, workforce levels, and job assignments.
2. Medium-range forecast; generally, spans from 3 month to 1 year. Used for sales planning, production planning and budgeting, and cash budgeting.
3. Long-range forecast; generally, spans more than 3 years. Used for product planning, capital expenditures, and facility location or expansion.

(Heizer & Render, 2011)

According to Heizer and Render (2011), there are several types of forecasting, namely as follows:

1. Economic forecast addresses the business cycle by predicting the rate of inflation, money supply, housing starts, and other indicators.
2. Technological forecast related to rates of technological development, which can result in the creation of new products.
3. Demand forecasts are the projection of demand for products or services from the company. The result of the forecasts will drive a company's production, capacity, and scheduling systems and also will be used as inputs to financial, marketing, and personnel planning.

Judging from the approach of forecasting, there are two general approaches to forecasting, quantitative and qualitative approach. Quantitative forecasts use a variety of mathematical models that rely on historical data and/or associative variables to forecast demand. Meanwhile qualitative forecasts incorporate such factors as the decision maker's intuition, emotions, personal experiences, and value system in reaching a forecast.

Quantitative forecasting methods are divided into two main types of forecasting models, which are time series and causal model. Time series model is predicting on the assumption that the future is a function of the past with using historical data to make the forecast. While causal model, such as linear regression, incorporate the variables or factors that might influence the quantity being forecast.

2.5.2 Forecasting Methods

In this research, the forecasting methods used are time series methods which are linear trend method, quadratic trend method, exponential trend method, and S-curve logistic method. The calculation of the forecasts will be conducted using Minitab software.

1. Linear Trend Method

Linear trend estimation is a mathematical method for assisting with data interpretation. By comparing the measurements to the times at which they occurred, pattern estimation may be used to render and explain conclusions about tendencies

in the data when a sequence of measurements of a process is viewed as, for example, a time series. This method can be calculated using the following formula.

$$y = a + bX \tag{2.1}$$

Where,

$$a = \frac{\sum Y}{n} \tag{2.2}$$

And,

$$b = \frac{\sum XY}{X^2} \tag{2.3}$$

2. Quadratic Trend Method

The values of a time series with a quadratic trend tend to rise or fall at a rate that is not constant; it changes over time. As a consequence, there is no straight line in the trend. This method can be calculated using the following formula.

$$y = a + bX + cX^2 \tag{2.4}$$

Where,

$$a = \frac{(\sum Y - c\sum X^2)}{n} \tag{2.5}$$

$$b = \frac{\sum XY}{\sum X^2} \tag{2.6}$$

And,

$$c = \frac{\{n\sum X^2Y - (\sum X^2)(\sum Y)\}}{\{n\sum X^4 - (\sum X^2)^2\}} \tag{2.7}$$

3. Exponential Trend Method

Exponential trends are often used to predict population, national income, production, sales results, and other events that develop or grow geometrically. This method can be calculated using the following formula.

$$\log y = \log a + (\log b)X \tag{2.8}$$

Where,

$$\log a = \frac{(\sum \log Y)}{n} \tag{2.9}$$

And,

$$\log b = \frac{\{\sum X(\log Y)\}}{\sum X^2} \tag{2.10}$$

4. S-Curve Logistic Method

A logistic function or logistic curve is a common S-shaped curve and can be applicated in a range of fields such as biology, chemistry, demography, economics, etc. This method can be calculated using the following formula.

$$f(x) = \frac{L}{1 + e^{-k(x-x_0)}} \tag{2.11}$$

Where,

x_0 : the x value of the sigmoid's midpoint

L : the curve's maximum value

k : logistic growth rate or steepness of the curve

After the calculation of the forecast, the calculation of errors using Mean Absolute Percentage Error (MAPE) and Mean Absolute Deviation (MAD) are conducted using the following formula.

$$MAPE = \frac{\sum_{t=0}^{n} \left| \frac{Y - y}{Y} \right|}{n} \times 100 \tag{2.12}$$

And,

$$MAD = \frac{\sum_{t=0}^{n} |Y - y|}{n} \tag{2.13}$$

Those indicators are used to validate the accuracy of the forecasting models. In this research, the calculation of the forecast and the validation are conducted using Minitab software.

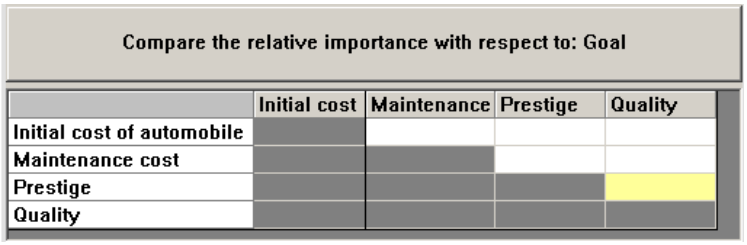
2.6 Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process (AHP) is one of multi-criteria decision making (MCDM) method that helps the decision-maker facing a complex problem with multiple conflicting and subjective criteria such as selection of a location or investment, prioritize the determination of projects to be held etc. (Ishizaka & Labib, 2009). Similar to the other MCDM methods such as ELECTRE, MacBeth, and SMART, AHP is based on four steps: problem modelling, weights valuation, weights aggregation, and sensitivity analysis.

a. Problem Modelling

As the decision-maker(s), in the decision-making processes, they will need a long time to structure the problem, which can be divided into three parts: goal, criteria, and alternatives. AHP has the advantage of permitting hierarchical structure of criteria, which allows users to focus on specific criteria and sub-criteria when allocating the weights.

b. Pairwise comparisons



Compare the relative importance with respect to: Goal

	Initial cost	Maintenance	Prestige	Quality
Initial cost of automobile				
Maintenance cost				
Prestige				
Quality				

Figure 2. 1 Comparison Matrix of The First Node

(Source: Ishizaka & Labib, 2009)

A pairwise comparisons of the decision-maker will be collected in a matrix at each node of the hierarchy just like the example in Figure 2.1. According to the psychologists argue, it is easier and more accurate to express one's opinion on only two alternatives than simultaneously on all the alternatives. It allows consistency and cross checking between the different pairwise comparisons. AHP is using a ratio scale judgement, which is a relative value or two quantities which have the same units. The decision maker does not require a numerical judgement, but using a relative verbal appreciation instead.

c. Judgement Scales

One of the advantages of using AHP is the possibility to evaluate quantitative as well as qualitative criteria and alternatives on the same scale of nine levels. The method used can be numerical, verbal, or graphical as shown at the Figure 2.2, Figure 2.3, and Figure 2.4.

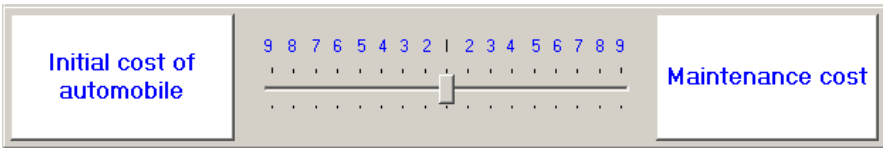


Figure 2. 2 Numerical scale

(Source: Ishizaka & Labib, 2009)

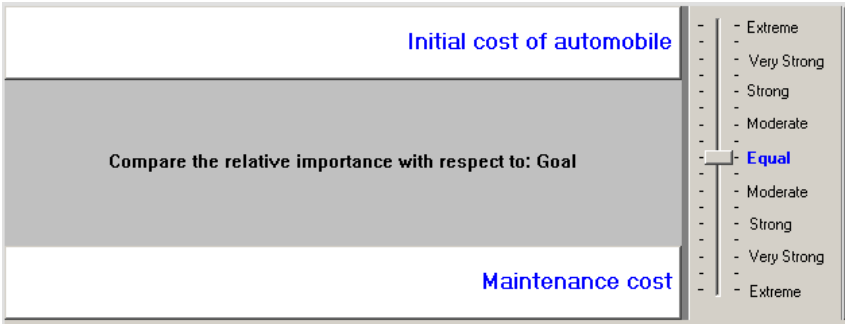


Figure 2. 3 Verbal scale

(Source: Ishizaka & Labib, 2009)

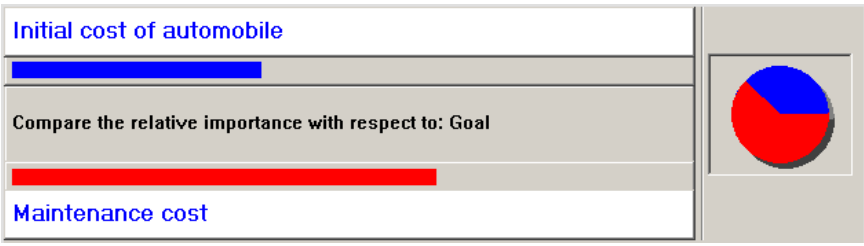


Figure 2. 4 Graphical scale

(Source: Ishizaka & Labib, 2009)

d. Priorities Derivation

In this step, the comparison matrix is filled by the decision-maker. So, when the matrix has been filled, the priority value can be calculated by using Formula 2.14.

$$A\,\vec{p} = n\,\vec{p} \tag{2.14}$$

Where,

$\vec{p}$: vector of the priorities

n : dimension of the matrix

A : comparison matrix

e. Consistency

A consistency check must be applied as priorities only make sense if derived from consistent or near consistent matrices. Consistency index (CI) is related to the eigenvalue method using Formula 2.15.

$$CI = \frac{\lambda_{max} - n}{n - 1} \tag{2. 15}$$

Where,

λ_{max} : maximal eigenvalue

After obtaining the consistency index, the consistency ratio can be calculated by using Formula 2.16.

$$CR = \frac{CI}{RI} \tag{2. 16}$$

Where,

RI : average of consistency index

If the CR value is less than 10%, the matrix can be considered as having an acceptable consistency.

(Saaty, 1977)

f. Aggregation

At the aggregation stage, which is also the last stage in determining the weight of the criteria, a priority synthesis of the location criteria is carried out by comparing them with all criteria globally as shown in the following formula.

$$p_i = \sum_j w_j \cdot l_{ij} \tag{2. 17}$$

Where,

p_i : global priority of the alternative *i*

w_j : weight of the criterion *j*

l_{ij} : local priority

g. Sensitivity Analysis

Sensitivity analysis is the last step of the decision process using AHP method, where the input data are slightly modified in order to observe the impact on the result.

In this research, AHP method will be done using Expert Choice software to determine priorities of several factors which later will be used in the weighted overlay function in the data processing.

2.7 Spatial Analysis

Spatial analysis is a type of geographical analysis which seeks to explain patterns of human behavior and its spatial expression in terms of mathematics and geometry, that is, locational analysis (Mayhew, 2004). In the early development of spatial analysis, this method was used by different analytical approaches and applied in astronomy, which is used to develop science in determining the location of galaxies. In the development, spatial analysis can be applied for chip fabrication in computers so it can adjust in place and route related algorithms so that a complex structure can be constructed in a very small object (Gunarta & Ramadhani, 2014).

In this research, author is using spatial analysis in ArcGIS software. In the ArcGIS software, spatial analysis can be used to solve several issues, namely:

a. Deriving new information from existing data

Spatial analyst tool is used to create useful information from the source data, such as deriving distance from points, polylines, or polygons; calculating population density from measured quantities at certain points; reclassifying existing data into suitability classes; or creating slope, aspect, or hill shade outputs from elevation data.

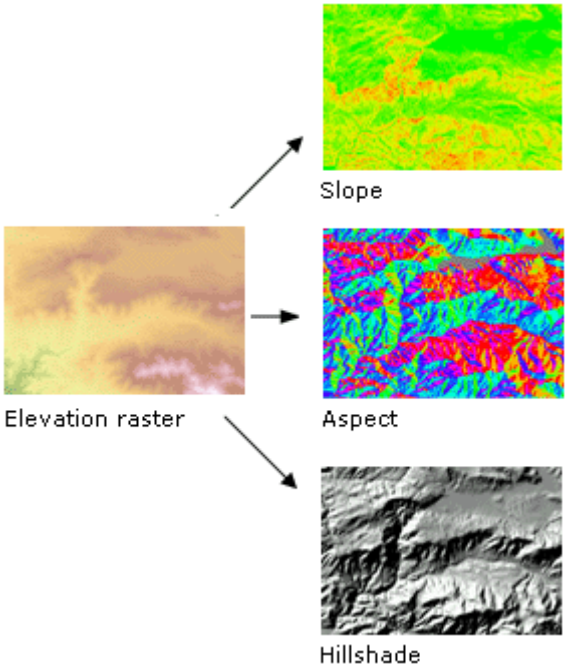


Figure 2. 5 Derive New Information from Existing Data

(Source: arcgis.com)

b. Find suitable locations

Finding areas that are the most suitable for particular objectives by combining layers of information. For example, based on a set of input criteria defining those areas of vacant land with the least steep terrain that are nearest to roads would be most suitable for a development project.

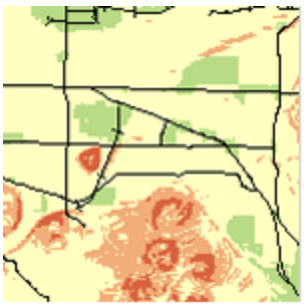


Figure 2. 6 Identifying suitable locations

(Source: arcgis.com)

c. Perform distance and cost-of-travel analysis

Spatial analyst in ArcGIS also can be used to create Euclidean distance surfaces to understand the straight-line distance from one

location to another, or create cost-weighted distance surfaces to understand the cost of getting from one location to another based on a set of input criteria that already specified.

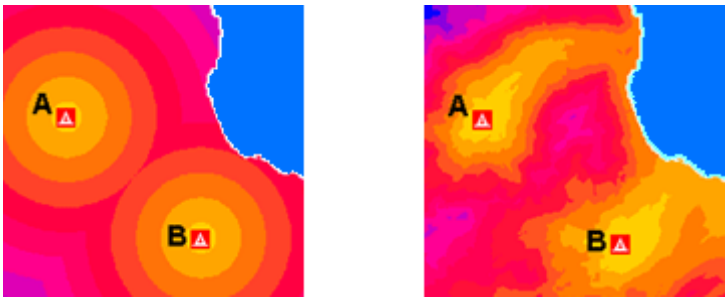


Figure 2. 7 Distance and cost-of-travel analysis

(Source: arcgis.com)

d. Identify the best path between locations

Spatial analyst in ArcGIS also can be used to identify the best path or optimum corridors for roads, pipelines, or animal migration, factoring in economic, environmental, and other criteria.

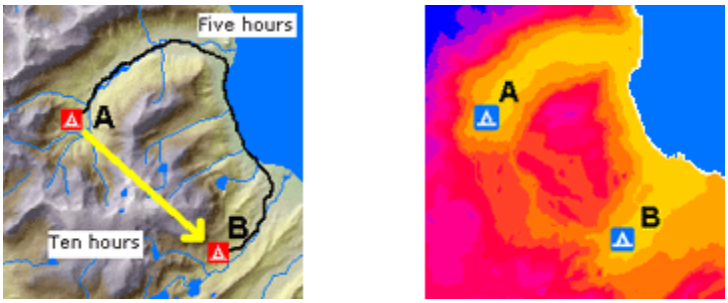


Figure 2. 8 Identify corridors or best paths between locations

(Source: arcgis.com)

e. Perform statistical analysis based on the local environment, small neighborhoods, or predetermined zones

Spatial analyst in ArcGIS also can be used to perform calculations on a per-cell basis between multiple rasters, such as calculating the mean crop yield over a 10-year period. Study a neighborhood by calculating, for example, the variety of species contained within it. Determine the mean value in each zone, such as the mean elevation per forest zone.

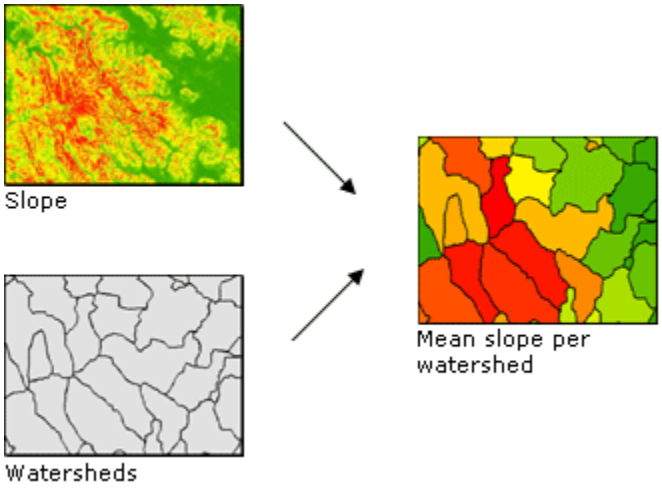


Figure 2. 9 Zonal calculations, such as the average slope of the landform per watershed (Source: arcgis.com)

f. Interpolate data values for a study area based on samples

Spatial analyst in ArcGIS also can be used to measure a phenomenon at strategically dispersed sample locations and predict values for all other locations by interpolating data values. Create continuous raster surfaces from elevation, pollution, or noise sample points. With a set of point spot heights and vector contour data, create a hydrologically correct elevation surface.

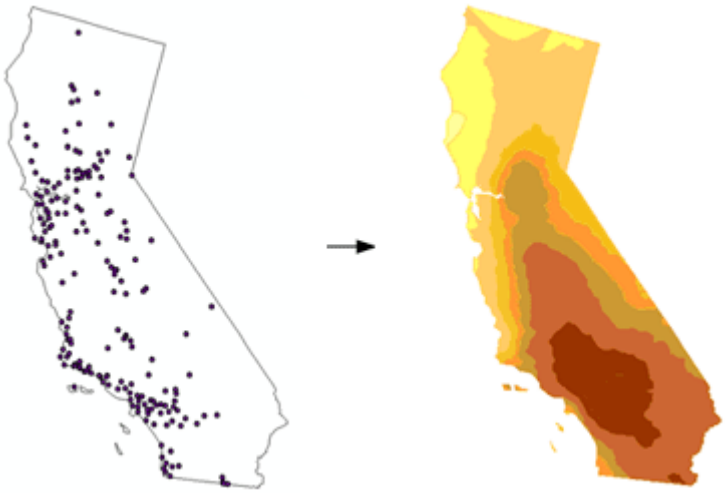


Figure 2. 10 Interpolating point sample data to a continuous raster surface (Source: arcgis.com)

g. Clean up a variety of data for further analysis or display

Spatial analyst in ArcGIS also can be used to clean up raster datasets that contain data that is either erroneous, irrelevant to the analysis at hand, or more detailed.

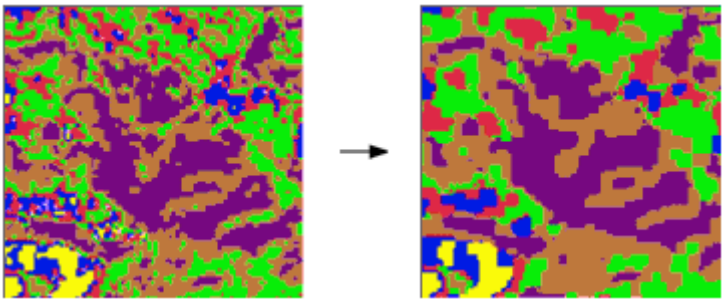


Figure 2. 11 Generalizing an input raster

(Source: arcgis.com)

(ESRI, 2020)

2.8 Geographic Information System (GIS)

A geographic information system (GIS) is a framework for gathering, managing, and analyzing data. rooted in the science of geography, GIS integrates many types of data. It analyzes spatial location and organizes layers of information into visualizations using maps and 3D scenes. With this unique capability, GIS reveals deeper insights into data, such as patterns, relationships, and situations and helping users make smarter decisions (ESRI, 2017).

Another definition of GIS formulated by National Geographic (2017), GIS is a computer system for capturing, storing, checking, and displaying data related to positions on earth's surface. By relating seemingly unrelated data, GIS can help individuals and organizations better understand spatial patterns and relationships.

GIS works on a lot of scales. At its most basic level, geographic information systems technology is used for computer cartography or simple map creation. The real strength of GIS comes from its ability to analyze attribute and geographic data using spatial and statistical methods. The analysis may produce derivative information, interpolated information, or prioritized information as a result (Dempsey, 2019).

GIS can be used in problem-solving and decision-making processes, as well as for data visualization in a spatial environment. The location of features and their relationships to other features, the density of features in a given space, what is happening within an area of interest (AOI), what is happening nearby some feature or phenomenon, and how a particular area has changed over time can all be determined using geospatial data.

1. Mapping where things are

   Users can map the spatial location of real-world features and visualize the spatial relationships among them.

2. Mapping quantities

   People map quantities, such as where the most and least are, to find places that meet their criteria or to see the relationships between places.

3. Mapping densities

   GIS also can be used to map concentrations, or a quantity normalized by area or total number.

4. Finding what is inside

   Users can use GIS to determine what is happening or what features are located inside a specific area. Users can determine the characteristics of "inside" by creating specific criteria to define an area of interest (AOI).

5. Finding what is nearby

   Users can find out what is happening within a set distance of a feature or event by mapping what is nearby using geoprocessing tools like buffer.

6. Mapping change

   Users can map the change in a specific geographic area to anticipate future conditions, decide on a course of action, or to evaluate the results of an action or policy.

(Dempsey, 2019)

According to Dempsey (2019), GIS users need to understand the components of GIS in order to understand how GIS works. Those components are:

1. Hardware

   Hardware refers to the tools that are used to support the various tasks involved in geospatial research, such as data collection and analysis. The

workstation, which runs the GIS program and serves as the attachment point for ancillary equipment, is the most important piece of desktop GIS equipment. Handheld field technology and mobile GIS are becoming increasingly common data collection tools in GIS. Web servers have become an important piece of equipment as a result of the introduction of web mapping.

2. Software

The importance of various types of software cannot be overstated. The GIS framework kit is at the heart of this. Since such software is required for creating, editing, and analyzing spatial and attribute data, these packages provide a variety of geospatial functions. Extensions, also known as add-ons, are applications that enhance the GIS software package's capabilities. Application software is the polar opposite of component GIS software. Component GIS aims to create software applications that serve a particular function, so its spatial analysis capabilities are minimal. Utilities are self-contained programs that perform a single task.

3. Data

Any GIS relies on data to work. Vector and raster data are the two main types of data used in GIS. A geodatabase is a database that is linked to geographic locations in some way. Vector and raster geodatabases are the two types of geodatabases. Points, lines, and polygons are used to represent vector data. Aerial imagery and digital elevation models are examples of raster data. This data is often accompanied by attribute data. Attribute data is a type of tabular data that contains additional information about each spatial function.

Metadata is the term for the documentation of GIS datasets. The coordinate system, when the data was generated, when it was last updated, who created it and how to contact them, and descriptions for each of the code attribute data are all contained in metadata.

GIS data can be obtained in a number of different ways. GIS data is generated in a variety of ways, including head up digitizing (the method

of tracing GIS data directly on the screen), LiDAR, drones, GPS, and satellites.

4. People

   GIS experts who are well-versed in spatial analysis and proficient in the use of GIS software are critical to the GIS process. Education, career path, and networking are the three components of the people aspect. The right education is crucial, as is taking the right classes in the right order. It's critical to choose the right GIS career. If you have a strong background in GIS analysis but haven't taken the requisite programming lessons, you shouldn't apply for a job as a GIS developer. Finally, continuous networking with other GIS practitioners is essential for the exchange of ideas as well as the creation of a support network.

In Geographical Information Systems, there is a tool called the geoprocessing tool. Geoprocessing itself is a framework of a variety of tools that can be used to process geographic information and the related data that accompanies it. So that the geoprocessing tool is a command or function in the application in carrying out an operation based on GIS data. In the software used by the author, namely ArcGIS, the use of geoprocessing tools can be done through toolboxes that behave like a folder of many tools. So, with this tool, a case like the one being solved in this research will be at the core of determining the desired result where the thing that is desired from this research is a weighted overlay map that can be solved with a tool in the form of a weighted overlay.

2.9 Financial Modelling

Financial modelling is the process of creating a summary of a company's expenses and earnings in the form of a spreadsheet that can be used to calculate the impact of a future event or decision (Kopp, 2020). Financial model has many uses for company executives such as to determine the feasibility of a project. Financial modeling is a representation in numbers of a company's operations in the past, present, and the forecasted future (Gunarta, 2020). In this report, the financial modelling topics focused by the author are Financial Projection Model, Discounted

Cash Flow (DCF), Free Cash Flow (FCF), cost of capital, terminal value, depreciation, amortization, and inflation.

2.9.1 Financial Projection Model

Integrated financial statement projection model, is a spreadsheet method which is custom-made to do an integrated financial calculation of a specific financial condition of a business so that it can produce a financial disclosure of a projected financial performance of the business with the same manner as the present financial statements (Tjia, 2009). The focus of this model is to represent business performance projection through the relation between financial statements that includes income statement, balance sheet, and cash flow statement. The explanation for each financial statement can be seen below.

1. Income statement is also known as the profit and loss statement that reports a company's financial performance over a specific accounting period. Income statement focuses on four key items, which are revenue, expenses, gains, and losses.
2. Balance sheet is a financial statement that reports a company's assets, liabilities and shareholders' equity at a specific point in time, and provides a basis for computing rates of return and evaluating its capital structure. Balance sheet provides a snapshot of what a company owns, owes, and amount invested by shareholders.
3. Cash flows are the net amount of cash and cash-equivalents being transferred into and out of a business.

   The relation of financial statements can be seen in the Figure 2.12.

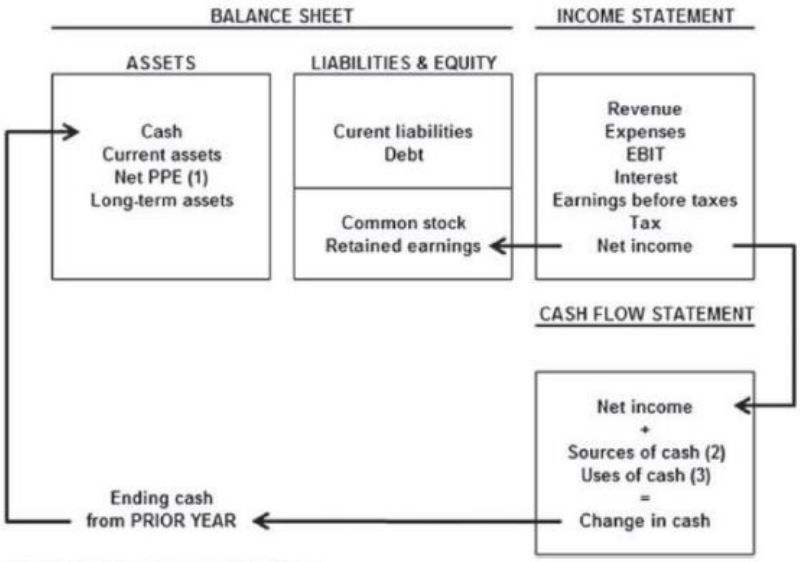


Figure 2. 12 Relation of Financial Statements

(Source: Tjia, 2009)

From the figure above, it can be seen that the integrated model required a clear financial information of several years to be able to generate a correct interrelation between each of the financial statements. A proper financial projection model should be able to measure business:

1. Earnings before Interest and Tax (EBIT) for revenue generating operation.
2. Earnings before Interest, Tax, Depreciation, and Amortization (EBITDA) for company's core operation cash generating measurement.
3. Revenue and Net Income for revenue generating ability.
4. Cash flow from operations
5. Operating working capital
6. Net Plant, Property, and Equipment (PPE); and CAPEX
7. Levels of debt and equity

2.9.2 Discounted Cash Flow (DCF)

Discounted cash flow is a valuation method used to estimate the value of an investment based on its expected future cash flows (Fernando, 2021). DCF analysis is used to know the value of an investment today, based on projections of how much money it will generate in the future. Meanwhile, cash flow is the representation of

total flow of cash over that specific time period. DCF formula is represented by Formula 2.18.

$$DCF = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} \tag{2. 18}$$

Where,

DCF : Discounted Cash Flow

CF_t : Cash Flow at Period t

r : Discount Rate

DCF is an important tool for decision making process as the result of the DCF will become the base for further financial parameter calculation.

2.9.3 Free Cash Flow (FCF)

Free cash flow is the cash a company generates after taking into consideration cash outflows that support its operations and maintain its capital assets, or the cash left over after a company pays for its operating expenses and capital expenditures (Murphy, 2021). Free cash flow is an important measurement since it shows how efficient a company is at generating cash. Free cash flow usually used to measure whether a company might have enough cash to pay investors through dividends or share buybacks. The formula of calculating FCF can be seen in the Formula 2.19.

$$\begin{aligned} FCF = \big(&EAT + Depreciation + Interest \times (1 - Tax)\big) \\ &- Working\ Capital\ Investment \\ &+ Fixed\ and\ Others\ Assets\ Investment\big) \end{aligned} \tag{2. 19}$$

2.9.4 Cost of Capital

Cost of capital is the required return necessary to make a capital budgeting project, such as building a new factory, worthwhile. Cost of capital usually mean the weighted average of a firm's cost of debt and cost of equity blended together (Hayes, 2021). Many companies are using a combination of debt and equity to

finance their businesses and the overall cost of capital is derived from the weighted average cost of all capital sources known as the weighted average cost of capital (WACC).

1. Cost of Debt

   Cost of debt is the effective interest rate a company pays on its debts, such as bonds and loans. Cost of debt is a part of a company's capital structure. It is also helpful in understanding the overall rate being paid by a company to use the types of debt financing. There are two approaches for calculating cost of debt, which are before and after-tax rate implementation. However, almost all of business form implements the after-tax rate cost of debt calculation. The formula of after-tax approach can be seen in the Formula 2.20.

$$R_D = R_{DBT}(1 - T) \tag{2. 20}$$

   Where,

   R_D : Cost of Debt

   R_{DBT} : Loan Interest Rate before Tax Implementation

   T : Tax Rate

2. Cost of Equity

   Cost of equity is the return a company requires to decide if an investment meets capital return requirements. Cost of equity represents the compensation the market demands in exchange for owning the asset and bearing the risk of ownership (Kenton, 2021). The formula for the cost of equity used in this research is the capital asset pricing model (CAPM). The formula of CAPM will be shown in Formula 2.21.

$$R_E = Rf + \beta i(Rm - Rf) \tag{2. 21}$$

   Where,

   R_E : Cost of equity

   Rf : Risk free rate

   Rm : Market return

Rm-Rf : Market risk premium

β : Un-diversifiable risk of stock relative to market return

3. Weighted Average Cost of Capital (WACC)

Weighted average cost of capital is a calculation of a firm's cost of capital in which each category of capital is proportionately weighted (Hargrave, 2021). A firm's WACC increases as the beta and rate of return on equity increase because an increase in WACC denotes a decrease in valuation and an increase in risk. The formula that will be used for WACC can be seen in Formula 2.22.

$$WACC = \left(\frac{E}{E+D}\right) R_E + \left(\frac{D}{E+D}\right) R_D \qquad (2.\ 22)$$

Where,

WACC : Weighted Average Cost of Capital

E : Amount of capital sourced from equity

D : Amount of capital sourced from debt

R_E : Cost of Equity

R_D : Cost of Debt

2.9.5 Depreciation and Amortization

Depreciation is an accounting method of allocating the cost of a tangible or physical asset over its useful life or life expectancy (Tuovila, 2021). While amortization is an accounting method used to periodically lower the book value of a loan or intangible asset over a set period of time (Fernando, 2021). The depreciation and amortization calculation approach used in this research is straight-line method with the Formula 2.23.

$$Depreciation\ Expense = \frac{Cost - Residual}{Life} \qquad (2.\ 23)$$

2.9.6 Inflation

Inflation is the decline of purchasing power of a given currency over time (Fernando, 2021). Inflation can be reflected in the increase of an average price level of a basket of selected goods and services in an economy over some period of time. The rise in the prices, means that a unit of currency buys less than it did in prior periods. There are three main causes of inflation, namely demand-pull, cost-push, and built-in. Demand-pull occurs when the demand of goods and services exceed their production capacity. Cost-push occurs when there is an increase in cost of production process's input which resulted to the higher price of finished goods. While built-in occurs as a result of cause-and-effect relation from a third cause. Inflation will affect how company view their assets value as it will have negative or positive impact on each asset. Hence, to minimize its negative impact, each country usually has a monetary authority organization or central bank. They set a target level of inflation rate periodically and maintain its volatility through times by implementing what is known as monetary policy.

2.10 Financial Feasibility Parameters for Alternative Selection

This subchapter will consist of the explanation about three financial modelling parameters used for alternative selection including Net Present Value, Internal Rate of Return, and Payback Period (Gunarta, 2020).

2.10.1 Net Present Value (NPV)

Net present value is the difference between the present value of cash inflows and the present value of cash outflows over a period of time (Fernando, 2021). NPV is usually used in capital budgeting and investment planning to analyze the profitability of a projected investment or project. NPV is a result of calculations used to find today's value of a future stream of payments. Below is the mathematical model of NPV calculation.

$$PW(i^*) = \sum_{t=0}^{n} F_t(1 + i^*)^{-t} \tag{2. 24}$$

Where,

PW : Present Worth

F_t : Cash Flow on Period t

i : Interest Rate ($0 \leq i \leq \infty$)

t : Investment Time Horizon

NPV calculation result has a simple basic rule which states that a financial decision can be considered as feasible if its NPV value equal to or larger than zero.

2.10.2 Internal Rate of Return (IRR)

The internal rate of return is a metric used in financial analysis to estimate the profitability of potential investments (Fernando, 2021). IRR is a discount rate that makes the NPV of all cash flows equal to zero in a discounted cash flow analysis. IRR calculation can be done using Formula 2.25.

$$IRR = 0 = \sum_{t=0}^{n} F_t(1 + i^*)^{-t} \tag{2. 25}$$

Where,

IRR : Internal Rate of Return

N : Number of periods in time horizon

F_t : Future value of cash flow in period t

i^* : Required return rate

t : Period in time horizon ($0 \leq t \leq n$)

IRR calculation result has a simple basic rule which states that a financial decision can be considered as feasible if its IRR value equal to or larger than the level of return or interest rate used for the DCF calculation.

2.10.3 Payback Period

Payback period (PP) refers to the amount of time it takes to recover the cost of an investment. In other words, the payback period is the length of time an investment reaches a break-even point (Kagan, 2021). The desirability of an investment is directly related to its payback period. Shorter paybacks mean more

attractive investments. There are two approaches to calculate PP which are basic PP and discounted PP. Basic PP does not consider the impact of time value of money, assumed that the interest rate is equal to zero. Below is the formula for basic PP calculation.

$$\sum_{t=0}^{n} F_t \geq 0 \tag{2. 26}$$

Where,

F_0 : Initial investment amount

F_t : Net cash flow on period t

The second approach is discounted PP which consider the impact of time value of money so it assumes that the interest rate in the financial modelling follow some pre-determined interest rate according to expected return of the financial decision. Below is the formula for discounted PP calculation.

$$\sum_{t=0}^{n} F_t(1+i)^{n-t} \geq 0 \tag{2. 27}$$

Where,

F_0 : Initial investment amount

F_t : Net cash flow on period t

i : Interest rate

The rule of thumb for alternative selection according to PP calculation result considers two main factors which are PP duration and IRR level. For the same IRR level, shorter PP duration will be more preferable. Meanwhile, if the IRR level is different, basically a financial decision return will be riskier if the PP is longer. However, a financial decision will be differed for each company according to the corporate risk appetite and targeted IRR level.

2.11 Sensitivity Analysis

Sensitivity analysis is used to determine how different values of an independent variable affect a particular dependent variable under a given set of assumptions (Kenton, 2020). This method study how various uncertainty sources in a mathematical model contribute to the overall uncertainty of the model. This technique is used in a specific boundary that depend on one or more input variables.

Sensitivity analysis is commonly used by economists and also known as a what-if or simulation analysis. The purpose of sensitivity analysis is to act as a supportive tool for decision making using financial model. This method allows for forecasting using historical data. By studying all the variables and the possible outcomes, decisions can be made about making investments. There are two approaches in conducting a sensitivity analysis, namely one-way and multi-way sensitivity analysis. The difference between those two methods lies in the number of input variable included in the calculation. The most common diagram to represent a result of a sensitivity analysis is using tornado diagram.

(This page is intentionally left blank)

CHAPTER 3
RESEARCH METHODOLOGY

This chapter will consist of information about the stet that were done by the author in conducting the research including data collection, data processing, data analysis and interpretation, and drawing conclusions and suggestions.

3.1 Flowchart of Research Methodology

In this sub-chapter, the steps of this research will be mentioned in a flowchart. Below is the flowchart of the research steps.

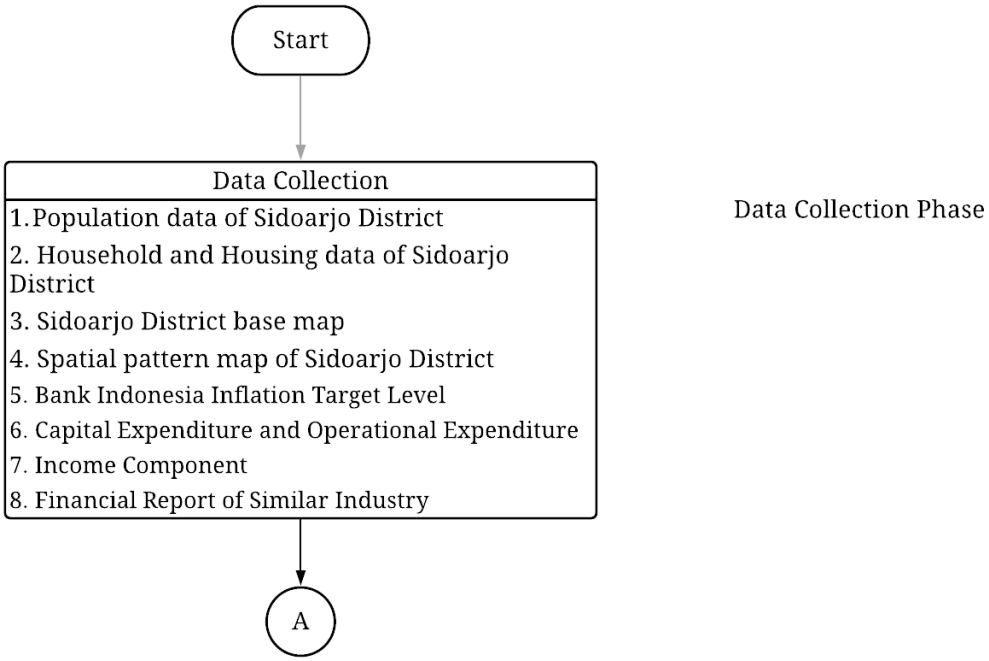


Figure 3. 1 Research Methodology Flowchart

(Source: Author's Document)

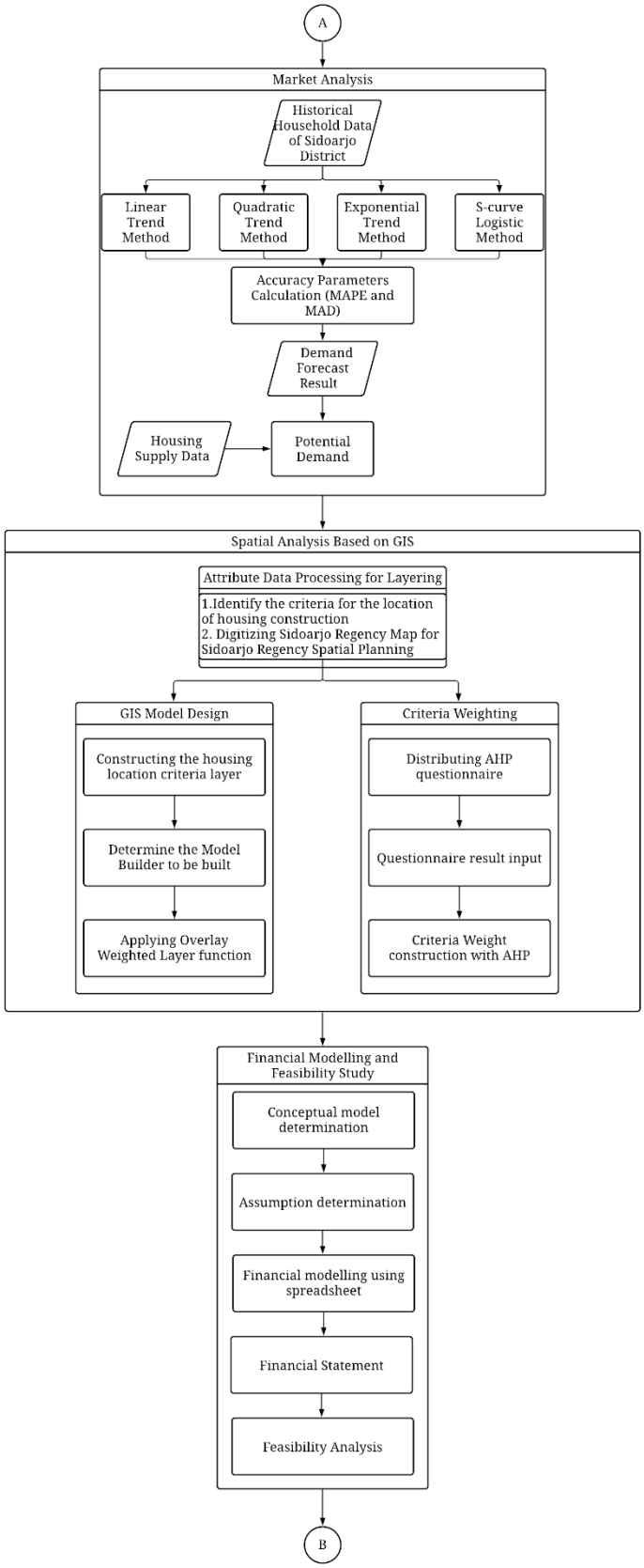


Figure 3. 2 Research Methodology Flowchart (Con't)

(Source: Author’s Document)

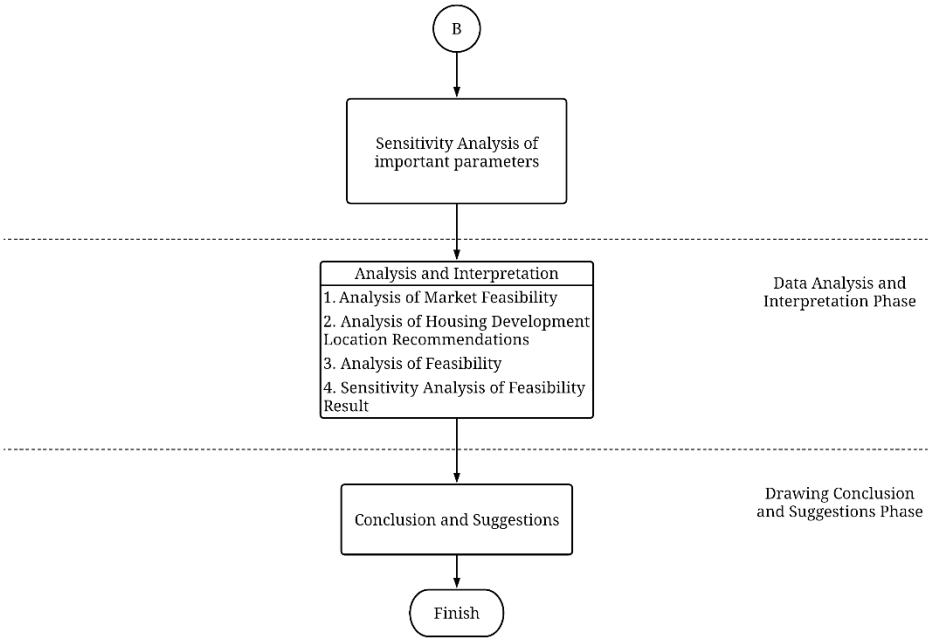


Figure 3. 3 Research Methodology Flowchart (Con't)

(Source: Author's document)

3.2 Description of Research Methodology

This sub-chapter will explain the flowchart that consists of steps that will be done in this research.

3.2.1 Data Collection Phase

In this phase, data collection is conducted to do the data processing in the next step. The data gathered are population data of Sidoarjo District, household and housing data of Sidoarjo District, Sidoarjo District base map, and spatial pattern map of Sidoarjo District. Some of the data collected during this phase must be in accordance with government regulations about the requirements regarding the location of housing development. In developing weighted overlay map, additional data such as spatial pattern map of Sidoarjo District is required. As for the financial modelling, data such as inflation level, capital expenditure (CAPEX) and operational expenditure (OPEX), income component of property business, and financial statement of similar company.

3.2.2 Data Processing Phase

After data collection phase is carried out and ensuring the data is complete and in accordance with what is needed, the next stage which is the data processing phase can be started. The data processing steps are explained below.

1. Market Analysis

   This step is done in order to know whether the housing development project in Sidoarjo District is feasible or not from the market perspective. This process is based on the supply and demand analysis of the housing in Sidoarjo District. To calculate the demand, it is required to forecast the household data from the historical data. Forecasting method used in this research is linear trend method, quadratic trend method, exponential trend method, and S-curve logistic method. After that, the accuracy calculation for the forecast result is conducted using MAPE and MAD formula, then the smallest value of the accuracy calculation will be used in the analysis. The result of the forecast, which is potential demand, later will be compared with the housing supply data to know whether the project is feasible or not.

2. Spatial analysis based on Geographic Information System

   This step is done in order to determine the priority location for housing development in Sidoarjo District. The process of GIS model design consists of several steps that will be explained below.

   a. Identify criteria used for location analysis

      The identification process of the criteria is based on the Technical Guidelines Pd T-03-2005-C concerning Procedures for Selection of Priority Locations for Housing and Settlement Development in Urban Areas by the Ministry of Public Works, there are general requirements for housing and settlement locations. The location of the residential area must be following the land use plan stipulated in the local Regional Spatial Plan or other spatial planning documents determined by the local Regional Regulation, or meet the following requirements:

      1. Not in a protected area;

2. Free from water, air, and sound, or other disturbances, whether man-made or natural resources such as floods, landslides, tsunamis;
3. The elevation of the land is less than 1,000 meters above sea level;
4. Land slope less than 15%;
5. In cities that have airports, do not interfere with the flight path of the aircraft;
6. The condition of the infrastructure is adequate;
7. Close to the activity and service centers of the city;
8. For lower-middle-income people, the linkage between housing locations and activity centers (workplaces) and city services will have economic implications.

Requirements above later will be the basis of the identification of the criteria. The process of identification will be discussed with the company.

b. Digitizing the map

This step is an important step to start the data processing using ArcGIS software. In the software, a base map is needed in order to process the map into a certain spatial data. In this case, the map that will be processed is Sidoarjo District map. This step is facilitated by the availability of complete data with the help of *Satu Peta Indonesia* policy which has been issued under the mandate of Presidential Regulation Number 9 of 2016 which regulates the realization of digital thematic maps for the entire territory of the Republic of Indonesia. The process of map digitization is conducted by downloading shape file of Sidoarjo District. In the downloaded file, there are complete data in the form of: district/city administrative boundaries, sub-district/village boundaries, distribution of agricultural and plantation locations, distribution of rice fields and fields, which later can be modified for use in the model builder.

c. Model Builder development

In a Geographic Information System, model builder can produce a model that varies depending on the purpose of the work. In this research, the model builder will be used to combine shapefiles into one raster data, and later can be continued using various tool in ArcGIS software.

d. Weighted Overlay of priority location

The next step is to process the model using Weighted Overlay Layer Tool in the Toolbox. Before this step, there is a requirement to provide several or at least one entity that will be modified using the tool. Those several entities have been collected in the data collection phase and the scoring system will be developed in order to conduct the spatial analysis based on expert judgement.

e. Criteria Weighting using Analytical Hierarchy Process

The criteria weighting in this research is needed in order to create appropriate scoring system to prioritize the criteria needed in housing development. The weighting process is conducted by three important steps. The first one is the distribution of AHP questionnaire to the expert to be judged. Then, the questionnaire result will be inputted into Expert Choice software. The last step is to construct the criteria weight using AHP method.

3. Financial Modelling and Feasibility Analysis

Financial modelling will be made starting by making a conceptual model of the business plan. The general input of the conceptual model will be inflation rate, house price in Sidoarjo district, CAPEX and OPEX of the business plan, revenue stream, financial statements of similar industry. Those input will be used to do the calculation process of supporting financial concepts such as cost of capital, terminal value, depreciation and amortization, inflation value, DCF, and FCF. The output of the model is financial statements of the business plan scenario over the observed time horizon. The next step of financial modelling is determining assumption needed to keep the model focused. Then,

building of financial conceptual model in a spreadsheet is conducted, implementing the assumption, input, and business plan financial attributes so it will produce a proper financial statement. Last step is to do the feasibility analysis. The feasibility analysis is done using financial statements as its input to build DCF and FCF to determine business plan feasibility, NPV, IRR, and payback period approach will be used for financial consideration.

4. Sensitivity Analysis

   Determining observed factor for sensitivity analysis is done using heuristic testing of the model. Sensitivity analysis is used to test how volatile the previous process result is and which factor(s) is the contribute most significantly to its change.

3.2.3 Data Analysis and Interpretation Phase

This phase will consist of analysis and interpretation of the result from data collection and processing. The analysis will be differentiated into three sub-chapters. The first one is analysis of market feasibility, which is needed to analyze the result of market analysis based on supply and demand whether the housing development project is feasible or not. Then the analysis of housing development location recommendation is done based on the result of the data processing using GIS. The priority location of the housing development project will be shown by the score of the zones, the higher the score of the zone, the higher priority of that zone to be the recommended location of the project. After that, analysis of feasibility is done based on the result of the financial model and the feasibility analysis. The last analysis is about sensitivity analysis explanation to consider a critical aspect in terms of independent variables included in the financial model and feasibility calculation of it and how it changes may affect the decision making.

3.2.4 Drawing Conclusion and Suggestion Phase

The last phase of the research will be a phase of drawing conclusion based on the whole process that is done throughout the research. The conclusion will be

drawn to answer the research objective. Then the suggestions are also formulated for PT. X and also for further research.

CHAPTER 4
MARKET ANALYSIS

This chapter will consist of information about data collection and processing steps that will be done by the author in doing market analysis of the housing market in Sidoarjo District. After the data collection and processing steps are done, the data analysis and interpretation are also done in this chapter regarding the market analysis.

4.1 Data Collection

This sub-chapter consists of information about required data to conduct the market analysis which are household and house data of Sidoarjo District. The data used is secondary data collected from BPS of Sidoarjo District and other related documents.

4.1.1 Household Data of Sidoarjo District

Historical data of Sidoarjo District's number of households will be used to determine the demand in this research. The number of households that do not have their own residential building will be considered as the demand in this analysis. Because of data limitations, the data used in this research only started from 2006 to 2018 that obtained from *Rencana Pembangunan dan Pengembangan Perumahan dan Kawasan Permukiman* (RP3KP) of Sidoarjo District in 2018. The data collected are shown in the Table 4.1.

Table 4. 1 Household Data of Sidoarjo District

Year	Number of Households
2006	436.202
2007	454.631
2008	474.117
2009	474.117
2010	558.235
2011	597.609
2012	615.781

Table 4. 1 Household Data of Sidoarjo District

Year	Number of Households
2013	615.781
2014	630.822
2015	630.822
2016	668.253
2017	674.391
2018	696.735

Source: RP3KP of Sidoarjo District, 2018

The data above shows the number of households in Sidoarjo District. In the data processing, these data later will be processed by using forecasting method to identify the demand of house in Sidoarjo District in the future.

4.1.2 House Data of Sidoarjo District

To determine the supply of house, the data of house in Sidoarjo is needed. Unfortunately, because of the limitations of data from Sidoarjo District, the data collected only the historical data of house development realization from year 1990 to 2010 and it will be the basis of the supply determination. The type of houses that includes in this data are *Rumah Sangat Sederhana* (RSS), *Rumah Sederhana* (RS), *Rumah Menengah* (RM), *Rumah Mewah* (MW), and *Rumah Toko* (Ruko). The data taken from *Rencana Program Investasi Infrastruktur Jangka Menengah* (RPI2JM) of Sidoarjo District will be shown in the Table 4.2.

Table 4. 2 House Development Realization in Sidoarjo District of 1990-2010

Sub-District	1990-1995					1996-2000					2001-2005					2006-2010					Total
	RSS	RS	RM	MW	Ruko	RSS	RS	RM	MW	Ruko	RSS	RS	RM	MW	Ruko	RSS	RS	RM	MW	Ruko	
Sidoarjo	1633	7276	3067	231	253	280	4488	937	14	186	-	1603	34	62	-	718	54	-	-	-	20836
Buduran	-	936	29	-	-	125	540	774	-	164	-	846	64	-	-	-	-	-	-	-	3478
Candi	2678	3125	479	-	-	1799	3553	107	-	-	-	2698	194	2	85	-	132	7	-	-	14859
Porong	-	-	-	-	-	-	23	1	3	-	-	-	-	-	-	-	-	-	-	-	27
Krembung	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Tulangan	-	-	-	-	-	-	-	-	-	-	-	4878	-	-	-	-	248	-	-	-	5126
Tanggulangin	521	-	-	-	-	618	479	-	-	198	-	953	83	-	92	-	-	-	-	-	2944
Jabon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Krian	293	216	-	-	-	408	2275	200	1	7	48	1089	23	-	21	-	801	15	-	-	5397
Balongbendo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Wonoayu	-	-	-	-	-	-	-	-	-	-	-	263	20	-	-	-	21	-	-	-	304
Tarik	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Prambon	-	-	-	-	-	-	-	-	-	-	-	182	-	-	3	-	452	22	-	21	680
Taman	1020	2055	886	37	124	845	1568	357	28	44	-	151	57	-	-	-	-	-	-	-	7172
Waru	251	1471	1447	221	142	903	299	116	-	-	-	-	220	1	-	-	25	180	-	-	5276
Gedangan	-	285	660	55	8	-	2303	217	10	-	-	148	47	-	-	-	-	-	-	-	3733
Sedati	181	1004	-	-	-	568	1603	6	2	6	-	374	-	-	-	-	46	-	-	-	3790
Sukodono	-	-	-	-	-	556	2327	160	-	18	-	2548	162	-	2	43	893	-	21	13	6743
Total	6577	16368	6568	544	527	6102	19458	2875	58	623	48	15733	904	65	203	761	2672	224	21	34	80365

Reflecting on the stagnant housing supply data, where in the 20-year period between 1990-2010 there were only an average of 4,018 house units built per year, the existing supply rate will not be able to stem the rate of housing demand in Sidoarjo District. In this research, the number of supplies will be assumed stagnant in the number of 4,018 units built per year.

4.2 Demand Forecasting

This sub-chapter consists of information about the data processing phase from the data collected in the previous sub-chapter. The demand data will be forecasted using four methods, which are linear trend method, exponential trend method, quadratic trend method, and s-curve logistic method. Those methods used in this research is determined based on the research done by Yusminar (2002) that used the similar method to determine the house demand of a city. The data processing will be using Minitab software to do the forecast. The demand forecasted will be until the year of 2025 as it will forecast the future demand 5 years from this research is done.

4.2.1 Linear Trend Method

The forecast using linear trend method will be done using Minitab software. The result of the forecast will be shown in the Table 4.3 and Figure 4.1.

Table 4. 3 Forecast Result using Linear Trend Method

Year	Number of Households
2006	436.202
2007	454.631
2008	474.117
2009	474.117
2010	558.235
2011	597.609
2012	615.781
2013	615.781
2014	630.822
2015	630.822
2016	668.253

Table 4. 3 Forecast Result using Linear Trend Method

Year	Number of Households
2017	674.391
2018	696.735
2019	735.654
2020	758.027
2021	780.401
2022	802.775
2023	825.148
2024	847.522
2025	869.896

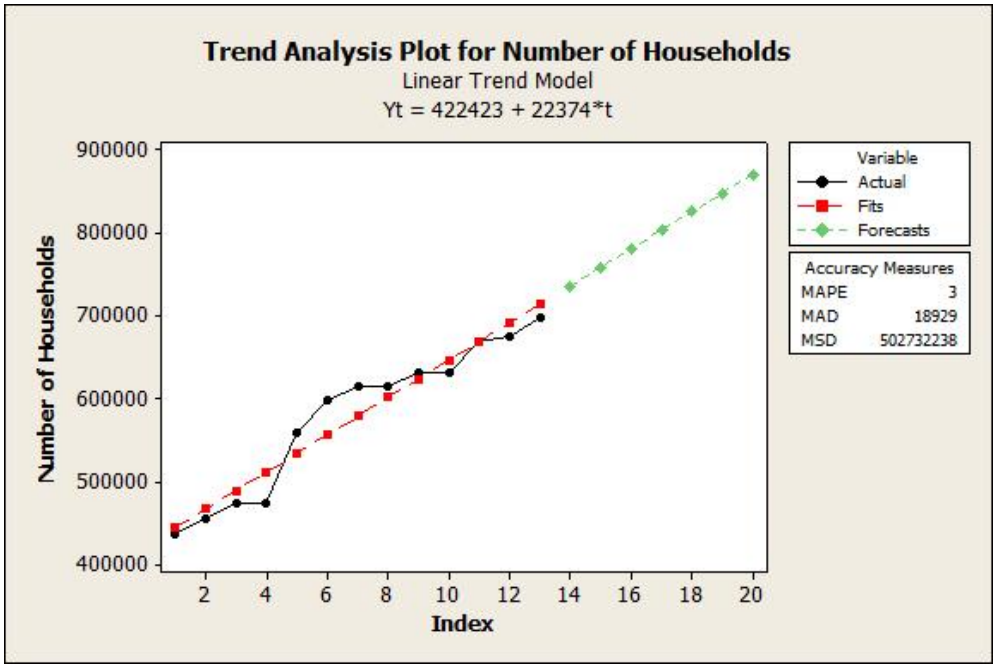


Figure 4. 1 Linear Trend Analysis Plot

From the figure above, the forecasted demand using linear trend method has MAPE value of 3 and MAD value of 18929.

4.2.2 Exponential Trend Method

The forecast using exponential trend method will be done using Minitab software. The result of the forecast will be shown in the Table 4.4 and Figure 4.2.

Table 4. 4 Forecast Result using Exponential Trend Method

Year	Number of Households
2006	436.202
2007	454.631
2008	474.117
2009	474.117
2010	558.235
2011	597.609
2012	615.781
2013	615.781
2014	630.822
2015	630.822
2016	668.253
2017	674.391
2018	696.735
2019	757.228
2020	788.155
2021	820.344
2022	853.849
2023	888.721
2024	925.018
2025	962.798

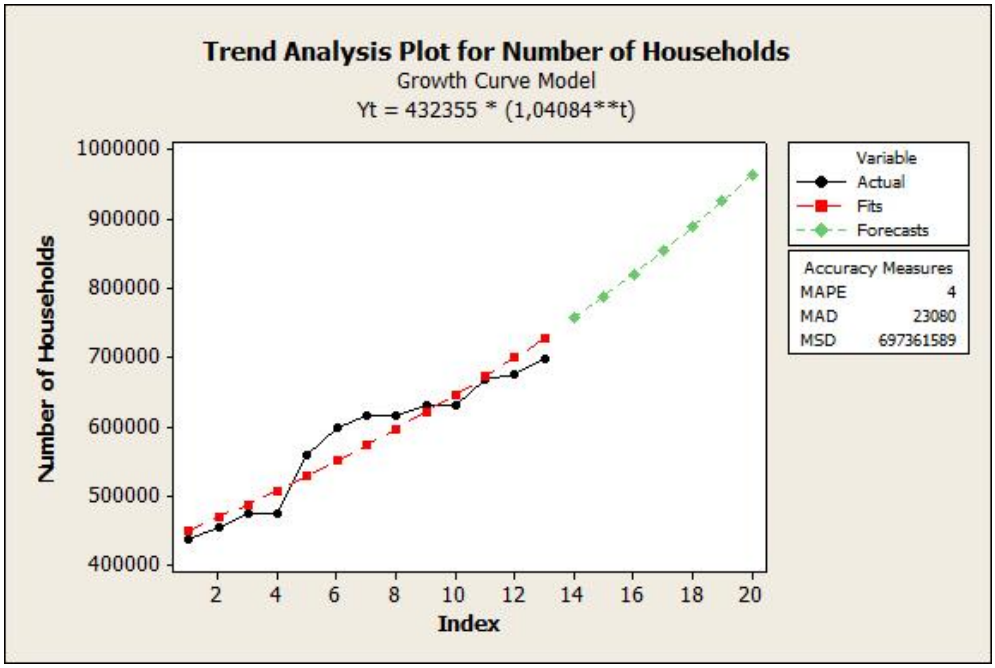


Figure 4. 2 Exponential Trend Analysis Plot

From the figure above, the forecasted demand using exponential trend method has MAPE value of 4 and MAD value of 23080.

4.2.3 Quadratic Trend Method

The forecast using quadratic trend method will be done using Minitab software. The result of the forecast will be shown in the Table 4.5 and Figure 4.3.

Table 4. 5 Forecast Result using Quadratic Trend Method

Year	Number of Households
2006	436.202
2007	454.631
2008	474.117
2009	474.117
2010	558.235
2011	597.609
2012	615.781
2013	615.781
2014	630.822
2015	630.822
2016	668.253
2017	674.391
2018	696.735
2019	697.513
2020	703.540
2021	707.388
2022	709.056
2023	708.545
2024	705.855
2025	700.985

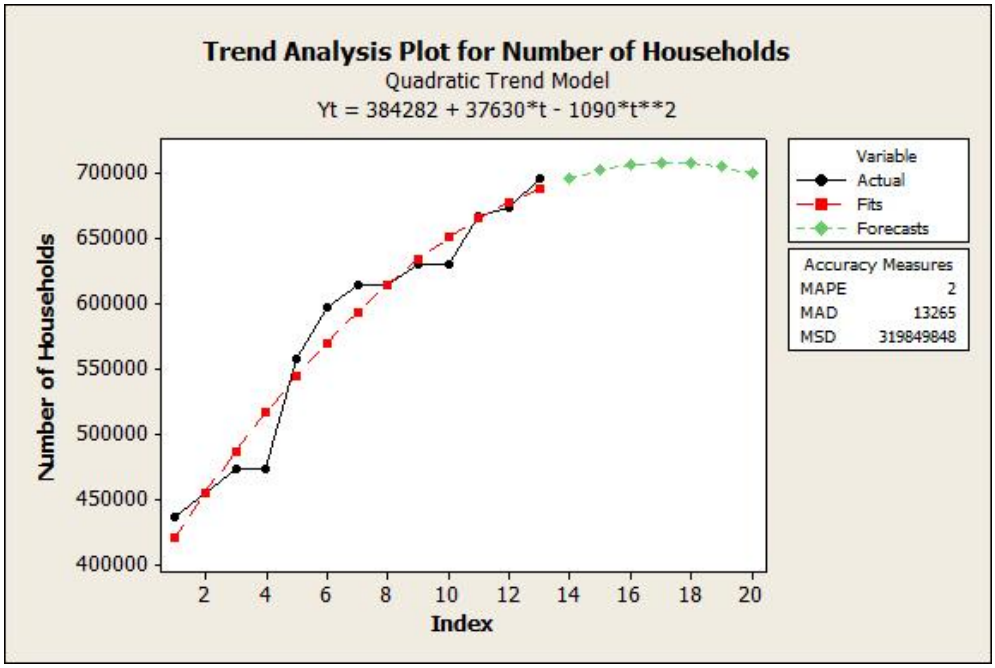


Figure 4. 3 Quadratic Trend Analysis Plot

From the figure above, the forecasted demand using quadratic trend method has MAPE value of 2 and MAD value of 13265.

4.2.4 S-Curve Logistic Method

The forecast using s-curve logistic method will be done using Minitab software. The result of the forecast will be shown in the Table 4.6 and Figure 4.4.

Table 4. 6 Forecast Result using S-Curve Logistic Method

Year	Number of Households
2006	436.202
2007	454.631
2008	474.117
2009	474.117
2010	558.235
2011	597.609
2012	615.781
2013	615.781
2014	630.822
2015	630.822
2016	668.253

Table 4. 6 Forecast Result using S-Curve Logistic Method

Year	Number of Households
2017	674.391
2018	696.735
2019	680.251
2020	683.139
2021	685.287
2022	686.883
2023	688.067
2024	688.943
2025	689.592

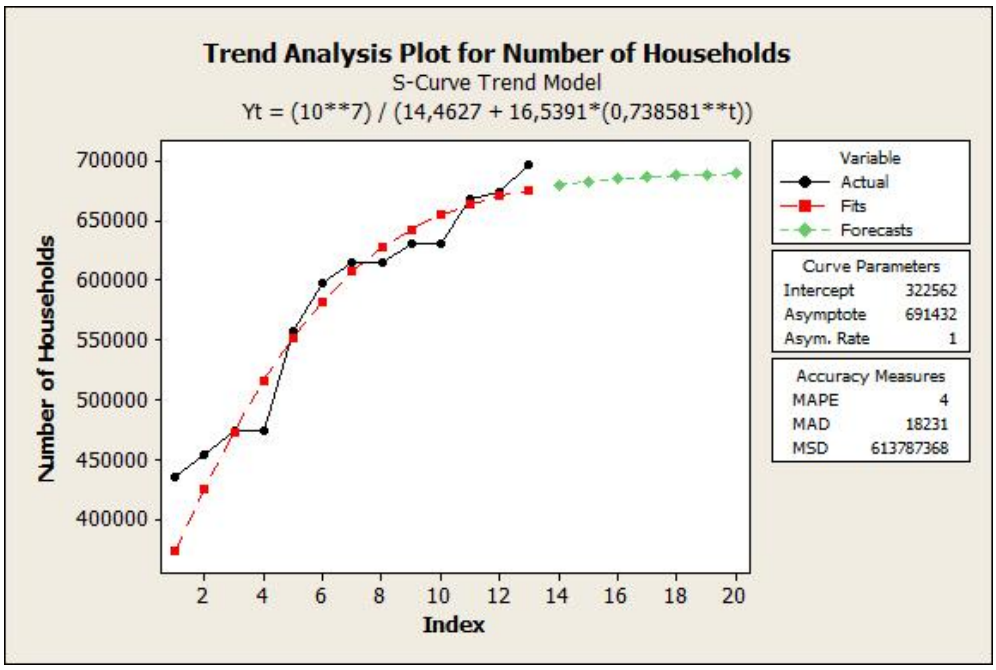


Figure 4. 4 S-Curve Trend Analysis Plot

From the figure above, the forecasted demand using s-curve logistic method has MAPE value of 4 and MAD value of 18231.

4.2.5 Potential Demand

Based on the result of the demand forecast using several methods in the previous process, the potential demand will be determined using the forecast result that has smallest value of MAPE and MAD. The comparation of the MAPE and MAD value for each method can be seen in the Table 4.7.

Table 4. 7 MAPE and MAD Recapitulation

Method	MAPE	MAD
Linear	3	18929
Exponential	4	23080
Quadratic	2	13265
S-Curve	4	18231

From the table above, it can be seen that method that has the smallest value of MAPE and MAD is quadratic trend method. Therefore, the potential demand will be considered based on the quadratic trend forecast result.

The potential demand in this analysis is the number of households that do not have their own residential building. In other words, it is assumed that the potential demand is the number of households that are renting houses. Based on the data from Bappeda of Sidoarjo District, the average of household that are renting house is 15,8% from the number of households. It can be concluded that the potential demand is 15,8% from the forecasted result of demand. Thus, the potential demand can be seen in the Table 4.8.

Table 4. 8 Potential Demand for 2021-2025

Year	Potential Demand
2021	111.767
2022	112.031
2023	111.950
2024	111.525
2025	110.756

4.3 Analysis of Market

The projection of the number of households that continues to increase will continue to increase the number of requests for housing as well as increase the backlog figure in Sidoarjo District. The backlog figure is still the main problem in providing housing in East Java Province, especially in Sidoarjo District. The number of backlogs in recent years continues to increase every year. The high number of housing backlogs occurs due to several factors, including large

population growth, inaccessibility of housing prices by the public, private parties who do not want to invest in providing low-income housing (MBR) due to high prices, etc. Even so, the pace of housing demand in Sidoarjo District is not matched by the supply of houses and housing. In the period 2014-2016, applications from property development companies for housing development and expansion continued to decline, starting from 58 applications in 2014, 40 applications in 2015, and 38 in 2016. From the total 426 housing estates in Sidoarjo District as of 2017, according to the Bappeda of Sidoarjo District, most of them are concentrated in only six sub-districts, out of 18 sub-districts in Sidoarjo. The six sub-districts include Buduran, Taman, Sedati, Waru, Candi, and Sidoarjo sub-districts. Three sub-districts in this district do not even have housing, namely Jabon District, Tarik District, and Krembung District.

In the last three years, the growth of housing in Sidoarjo District started to decline. The problem is that it is increasingly difficult for development companies to find land at low prices. As a result, it is buyers who have to bear the skyrocketing prices. For example, in urban areas, the minimum house price has reached Rp500 million, while in suburban areas the lowest is Rp350 million. Seeing this phenomenon, the government of Sidoarjo District intervened. Through Regent Regulation Number 59 of 2018, the minimum house area limit was lowered from 90 m^2 to 72 m^2 so that prices become more affordable.

Reflecting on the stagnant housing supply data, where in the 20-year period between 1990-2010 there were only an average of 4,018 housing units built per year, the existing supply rate will not be able to stem the rate of housing demand in Sidoarjo District. Moreover, the property industry is the most affected industry by the Covid-19 pandemic that has occurred since April 2020 until the time this research was conducted. The demand for residential houses fell sharply at the beginning of the pandemic, causing the property business to experience a decline of demand up to 60%. However, the demand is slowly showing a recovery, especially in the third quarter of 2020 where the housing price index grew by 4.29% or higher than the second quarter of 2020 of 3.93%. While demand recovered, housing supply continued to decline. In addition to restrictions on community movement so that housing development activities are also affected, the decline in

people's purchasing power which causes a drop in house prices has caused development companies to refrain from opening new projects.

Looking at the supply numbers above, it is certain that there is a large gap between the demand and supply of residential houses in Sidoarjo District. Even if the existing demand projections have been adjusted to the supply projections, there is still a wide market niche for residential housing demand. From the potential demand in the Table 4.8 are adjusted with stagnant supply projection of 4,018 housing units built per year, there are still unmet demand. Unmet demand is the needs or demands from customer that are not satisfied. The unmet demand can be seen in the Table 4.9.

Table 4. 9 Unmet Demand of House Projection

Year	Unmet Demand
2021	107.749
2022	108.013
2023	107.932
2024	107.507
2025	106.738

From the table above, it can be seen that the unmet demand of house in Sidoarjo District is still wide. Based on that fact, it can be concluded that if PT. X will carry out a housing development project in the meantime, the project will be feasible from the market perspective as the unmet demand number of houses in Sidoarjo District is still high.

CHAPTER 5
SPATIAL ANALYSIS

This chapter will consist of information about data collection and processing steps that will be done by the author in doing the priority location determination using spatial analysis based on Geographic Information System. After the data collection and processing steps are done, the data analysis and interpretation are also done in this chapter regarding the priority location determination.

5.1 General Description of PT. X Existing Condition

One of the housing developers in Sidoarjo District is PT. X. PT. X is one of the successful developers in providing *Rumah Sederhana Sehat* (RSH). Until now, PT. X has built eleven projects spread across four cities which are Malang, Pasuruan, Surabaya, and Sidoarjo. Currently, PT. X has four different lands across three sub-districts in Sidoarjo District that can be built into housing. Those lands are located in Balongbendo sub-district, Prambon sub-district, and Tanggulangin sub-district. The housing development project plan owned by PT. X includes the following four locations:

1. Location 1 with a land area of 220,000 m2.
2. Location 2 with a land area of 610,000 m2.
3. Location 3 with a land area of 600,000 m2.
4. Location 4 with a land area of 250,000 m2.

5.2 Identification of Criteria Used for Location Analysis

Sidoarjo is a district that is close to the second-largest city in Indonesia, namely Surabaya, where its geographical location close to the city of Surabaya makes Sidoarjo District a buffer district that is part of the Gerbangkertosusila Metropolitan Area. The role of this buffer district is also very important in the development of various business sectors around Sidoarjo District.

Sidoarjo District on a regional scale is located in East Java Province led by a regent who is also the coordinator of the administrative area under it which consists of 18 sub-districts which are further divided into 322 villages and 31 urban villages.

The following is information that will clarify conditions related to the administrative area in Sidoarjo District.

Table 5. 1 Administrative Data of Sub-Districts in Sidoarjo District

Sub-District	Area (km2)	Village	Urban Village
Balongbendo	31,4	20	
Buduran	41,03	15	
Candi	40,67	24	
Gedangan	24,06	15	
Krembung	29,55	19	
Krian	32,5	19	
Jabon	81	15	
Porong	29,82	13	6
Prambon	34,23	20	8
Sedati	79,43	16	
Sidoarjo	62,56	10	14
Sukodono	32,68	19	
Taman	31,54	16	
Tanggulangin	32,29	19	
Tarik	36,06	20	
Tulangan	31,21	22	
Waru	30,32	17	
Wonoayu	33,92	23	

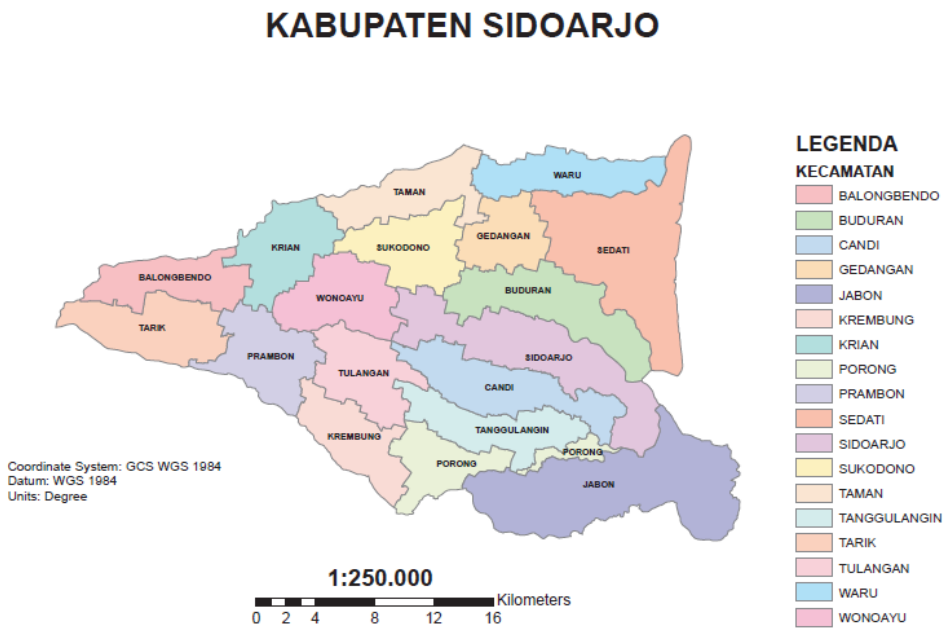


Figure 5. 1 Administrative Digital Map of Sidoarjo District

As a basis of identifying criteria that used to determine the priority location determination, author uses technical guidelines Pd T-03-2005-C concerning Procedures for Selection of Priority Locations for Housing and Settlement Development in Urban Areas by the Ministry of Public Works. In this guideline, there are general requirements for housing and settlement locations, namely:

a. Not in a protected area;
b. Free from water, air, and sound, or other disturbances, whether man-made or natural resources such as floods, landslides, tsunamis;
c. The elevation of the land is less than 1,000 meters above sea level;
d. Land slope less than 15%;
e. In cities that have airports, do not interfere with the flight path of the aircraft;
f. The condition of the infrastructure is adequate;
g. Close to the activity and service centers of the city;
h. For lower-middle-income people, the linkage between housing locations and activity centers (workplaces) and city services will have economic implications

The discussions between the author and the expert from PT. X to determine the criteria used in this research are done based on the technical guidelines above. The result of the criteria formulation can be seen in the Table 5.2.

Table 5. 2 Criteria of Priority Location Determination

PARAMETER	CLASS	Description	Reference
Distance to Main Road	Very Close	< 0,5 Km	(Saputra, et al., 2016)
	Close	0,5 - 1 Km	
	Medium	1 - 1,5 Km	
	Far	1,5 - 2 Km	
	Very Far	> 2 Km	
Land Slope	Flat	0% - 2%	Technical Guidelines Pd T-03-2005-C
	Medium	2% - 8%	
	Sloping	8% - 15%	
Distance to Electric Grid	Very Close	< 150 m	(Saputra, et al., 2016)
	Close	150 - < 300 m	
	Medium	300 - < 500 m	
	Far	500 - < 750 m	
	Very Far	> 750 m	
Distance to Health Facility	Very Close	< 750 m	(Saputra, et al., 2016)
	Close	750 - < 1500 m	
	Medium	1500 - < 2500 m	
	Far	2500 -< 5000 m	
	Very Far	> 5000 m	
Distance to Education Facility	Very Close	< 750 m	(Saputra, et al., 2016)
	Close	750 - < 1500 m	
	Medium	1500 - < 2500 m	
	Far	2500 -< 5000 m	
	Very Far	> 5000 m	
Spatial Pattern of Sidoarjo District	Industry	Gemopolis	(Saputra, et al., 2016)
		Industrial area	
		Mining Area	
		Industrial Zone	
	Airport	Juanda Airport Area	
	Protected	Cultural Heritage	
		Geological Protected Area (Mud Affected)	
		Mangrove Coastal Area	
	Trading	Kota Baru Area	
		Trade and Service Area	
	Settlement	Rural Settlement	

Table 5. 2 Criteria of Priority Location Determination

PARAMETER	CLASS	Description	Reference
		Urban Settlements	
	Agriculture	Other Cultivation	
		Rice Fields for Food Crops	
		Fisheries (Ponds, Public Water Pools)	
		Main Commodity Development Area (KAPUK)	
	Others	Military Area	
		Coastal Strategic Area	
		Purabaya Bus Terminal Area	
		Local Activity Center (Secondary Center)	
		Beach Border	
		River Border	
		River	

The criteria above later will be used as the main consideration of determining the priority location in this research. The characteristics of each criterion will be defined in the Table 5.3.

Table 5. 3 Criteria characteristics

PARAMETER	Description	Characteristic
Distance to Main Road	To know the distance of the location to the main road	Lower Better
Land Slope	To know the land slope of the location alternative	Lower Better
Distance to Electric Grid	To know the distance of the location to the electric grid	Lower Better
Distance to Health Facility	To know the distance of the location to the health facility	Lower Better
Distance to Educational Facility	To know the distance of the location to the educational facility	Lower Better
Spatial Pattern of Sidoarjo District	To ensure that the location is built in the settlement area	Only in settlement area, other than settlement area is restricted

The step after identifying the criteria as the consideration, those criteria later will be weighted to determine the influence of each criterion to the priority location determination.

5.3 Criteria Weighting Using AHP Method

In order to use Weighted Overlay function in ArcGIS, the data regarding influence of each criteria parameter. The calculation of each criteria parameter's influence is using Analytical Hierarchy Process method. In this research, the software used to calculate AHP is using AHP Calculator by Business Performance Management Singapore (BPMS), which will produce the influence value of each criterion as the result.

The assessment of the level of importance of each of these criteria is based on discussion of author and PT. X Project Consultant with the consideration of journal about determination of priority location using GIS in D.I Yogyakarta (Saputra, et al., 2016). The AHP assessment is filled by the PT. X Project Consultant. The recapitulation of the assessment will be shown in Table 5.3.

Table 5. 4 AHP Assessment of Criteria

Parameters																		
Aspect	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Aspect**
Distance to Main Road			x															Land Slope
Distance to Main Road						x												Distance to Electric Grid
Distance to Main Road							x											Distance to Health Facility
Distance to Main Road						x												Distance to Educational Facility
Distance to Main Road											x							Spatial Patterns of Sidoarjo
Land Slope												x						Distance to Electric Grid
Land Slope													x					Distance to Health Facility
Land Slope												x						Distance to Educational Facility
Land Slope															x			Spatial Patterns of Sidoarjo
Distance to Electric Grid											x							Distance to Health Facility
Distance to Electric Grid										x								Distance to Educational Facility
Distance to Electric Grid														x				Spatial Patterns of Sidoarjo

Table 5. 4 AHP Assessment of Criteria

Parameters																		
Aspect	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Aspect**
Distance to Health Facility								x										Distance to Educational Facility
Distance to Health Facility													x					Spatial Patterns of Sidoarjo
Distance to Educational Facility														x				Spatial Patterns of Sidoarjo

Based on the assessment above, the AHP calculation is conducted using AHP Calculator. Below is the result of the calculation.

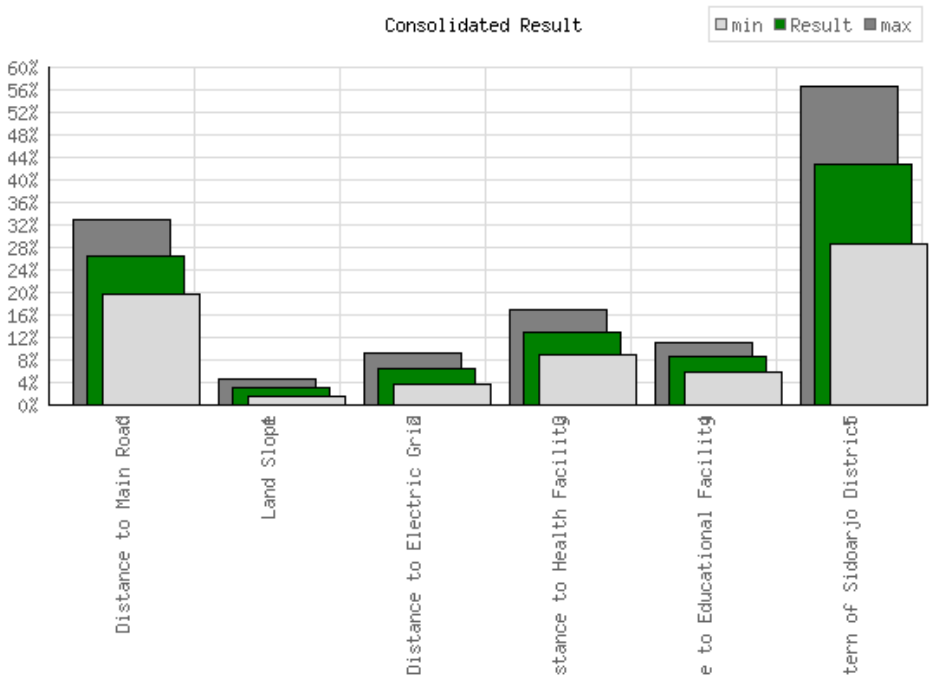


Figure 5. 2 AHP Consolidated Result

Table 5. 5 Influence of Each Criteria Parameters

Parameter	Influence
Distance to Main Road	26,40%
Land Slope	3,10%
Distance to Electric Grid	6,40%
Distance to Health Facility	12,90%
Distance to Education Facility	8,50%
Spatial Pattern of Sidoarjo District	42,70%

From the results of the AHP, each value of the level of importance or in ArcGIS is known as %influence which is useful as a determinant of the level of interest in a set of selected indicators. These result later will be useful in the process using Weighted Overlay function in ArcGIS in order to determine the priority location.

5.4 Map Digitation

Digitizing the map of Sidoarjo District is the first step of conducting the spatial analysis using ArcGIS. The data are obtained from *Satu Peta Indonesia* website. The digitation process is one layer by layer of the criteria parameters that are already determined before.

5.4.1 Main Road

From the condition of the road network that passes through or is found in Sidoarjo District, the Sidoarjo District Government is trying very hard to improve road facilities both in quantity (road length) and quality or condition of the road itself so that it is suitable for vehicles to pass. This is important because almost the entire area of Sidoarjo District is connected to land transportation facilities. In 2018, the total length of roads under the responsibility of the Sidoarjo District Government is 1009.8 kilometers. For this research, the data used is the main road of Sidoarjo District which are arterial road. Below is the detail map of the main road in Sidoarjo District.

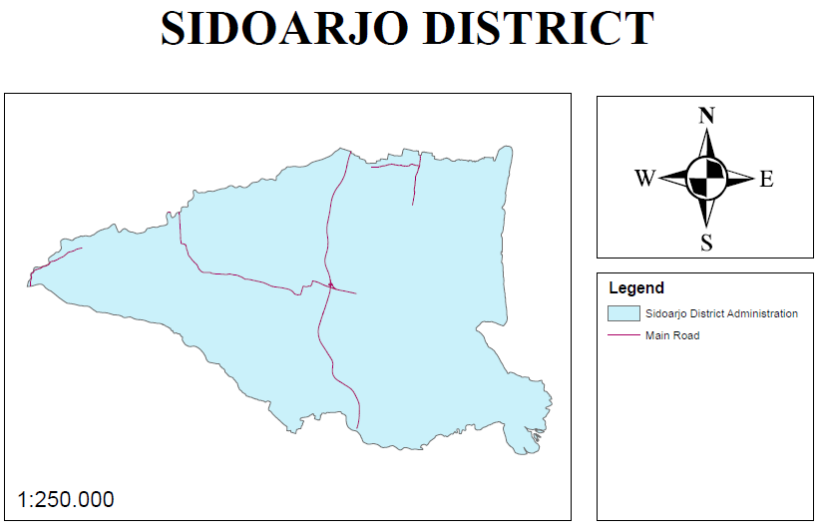


Figure 5. 3 Digital Map of Main Road in Sidoarjo District

Based on the type, arterial road can be divided into two types which are primary and secondary. Primary Arterial Road is one type of arterial road which is intended to connect between adjacent first-level cities or connect first-level cities with second-level cities. While Secondary Arterial Road is one type of arterial road which is intended to connect the primary area with the first secondary area or connect the first secondary area with other secondary areas or the first area with the second secondary area. Arterial road usually becomes the activity center of the city, so the distance to the main road becomes one of the criteria parameters in this research.

5.4.2 Land Slope

The slope of the land in Sidoarjo District is more dominated by a slope of less than 15% making Sidoarjo District a district that can be called relatively flat from its various existing areas. The detail of the land slope digital map can be seen in Figure 5.8.

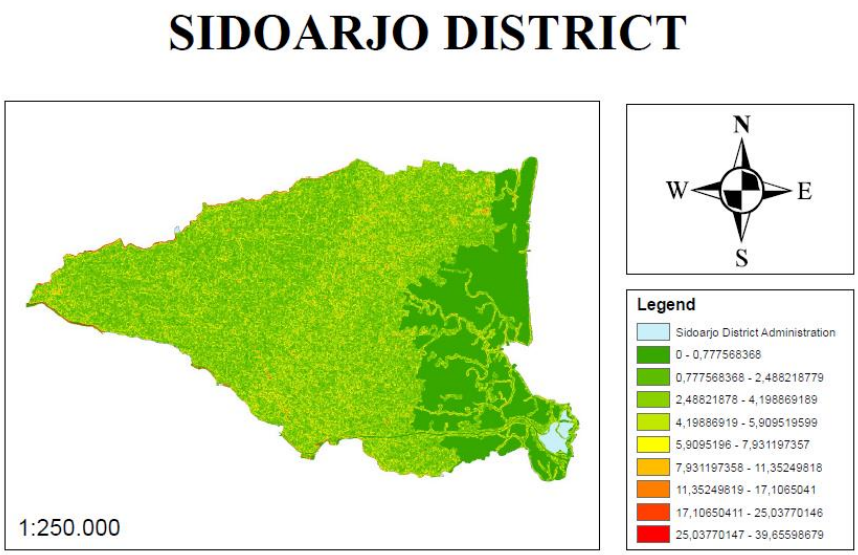


Figure 5. 4 Digital Map of Land Slope in Sidoarjo District

From the figure above, it can be seen that the land slope in Sidoarjo District is relatively flat, because there is no slope exceeds 11%. This condition is in accordance with technical guidelines Pd T-03-2005-C that states the slope of the land does not exceed 15%.

5.4.3 Electric Grid

The distance to the electric grid is also important in determining settlement location as electricity has become primary needs of people. The electric grid in Sidoarjo District can be seen in Figure 5.9.

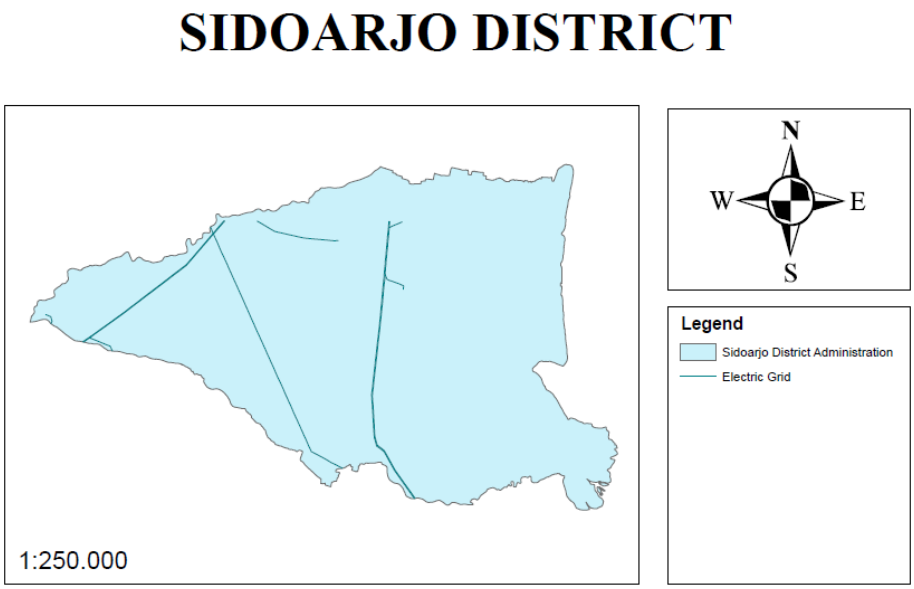


Figure 5. 5 Digital Map of Electric Grid in Sidoarjo District

5.4.4 Health Facilities

Health facilities are one of the first priority facilities that must always be provided to support health services for the surrounding community. The lowest level health facility in each sub-district is the public health center. The spread of health facility in Sidoarjo District can be seen in Figure 5.10.

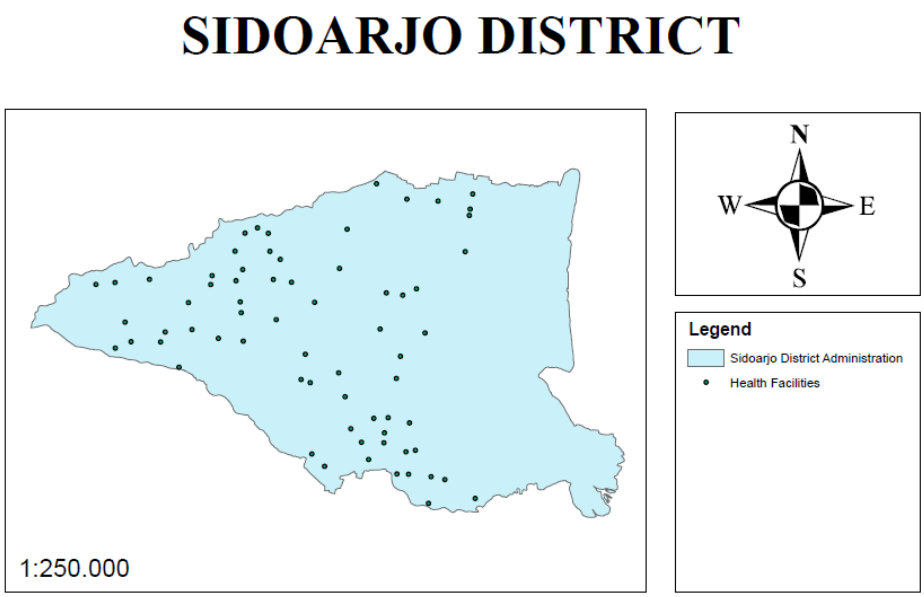


Figure 5. 6 Digital Map of Health Facilities in Sidoarjo District

5.4.5 Educational Facility

Educational facilities are one of the considerations in the selection of housing locations because they play an important role in efforts to improve the quality of human resources. Viewed from the aspect of location, housing close to educational facilities will greatly facilitate in terms of time efficiency. The spread of educational facilities in Sidoarjo District can be seen in the Figure 5.11.

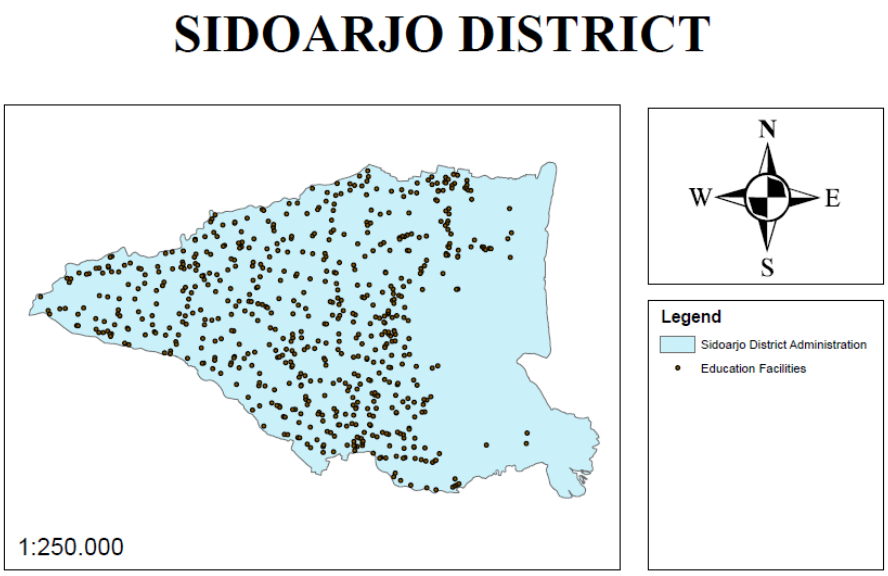


Figure 5. 7 Digital Map of Educational Facilities in Sidoarjo District

5.4.6 Spatial Patterns

In the spatial pattern of Sidoarjo District, there is a concept of a spatial pattern plan containing a distribution plan for allotment sub-zones including housing zones. The housing zone is a space designation consisting of a group of residential houses that accommodate the life and livelihood of the community which is equipped with its facilities. In this research, the housing only can be built in the settlement zone. The spatial pattern of Sidoarjo District can be seen in the Figure 5.12.

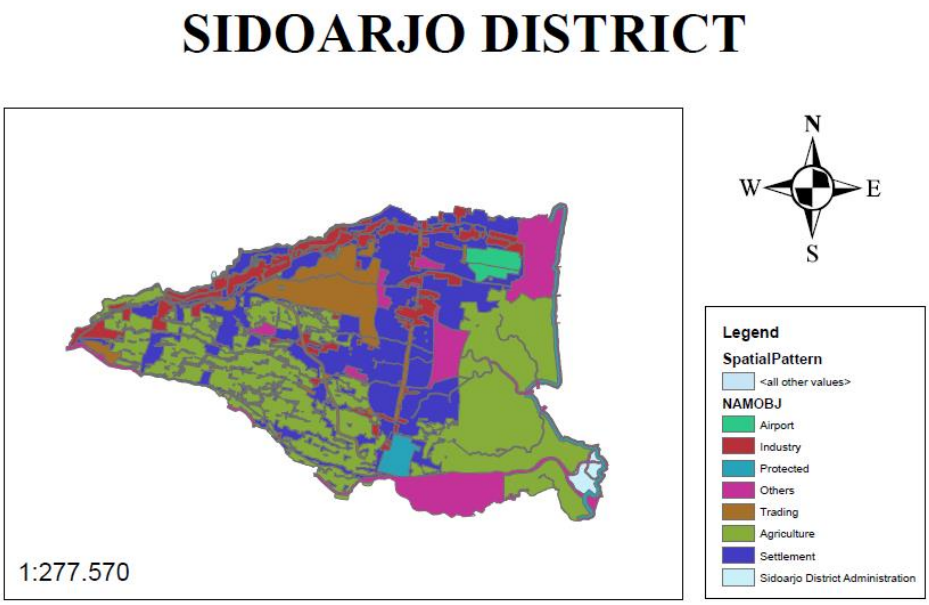


Figure 5. 8 Digital Map of Sidoarjo District Spatial Pattern

5.4.7 Final Map

After each criteria parameters digital map are already digitized, then the next process using ArcGIS can be done. The final result of combined parameters map for this research can be seen in Figure 5.13.

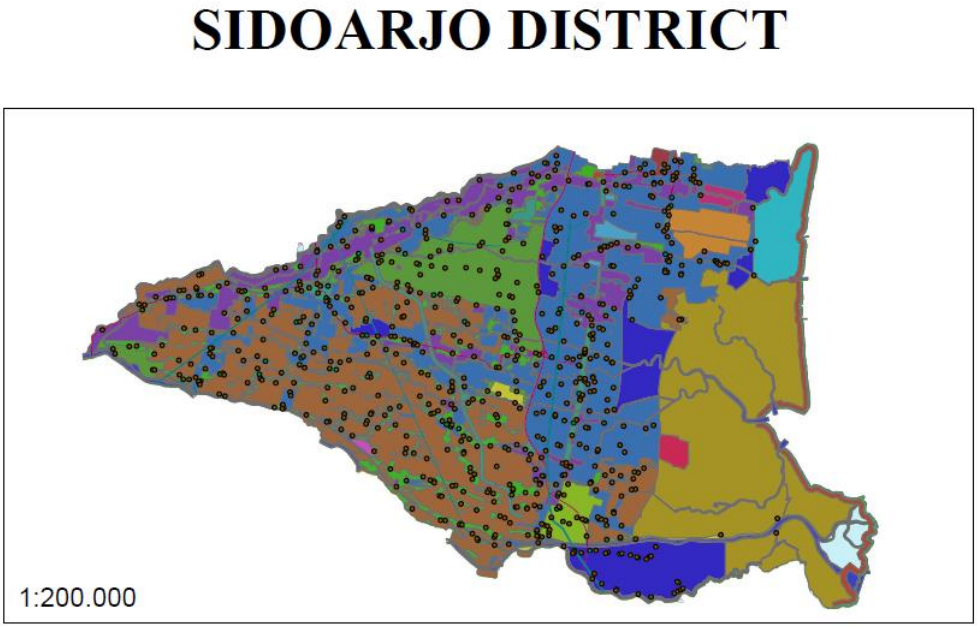


Figure 5. 9 Digital Map of Criteria Parameters in Sidoarjo District

5.5 Spatial Analysis Using GIS

In the data processing of the spatial analysis using ArcGIS software, the detailed step of the data processing can be seen in the Figure 5.14 and 5.15.

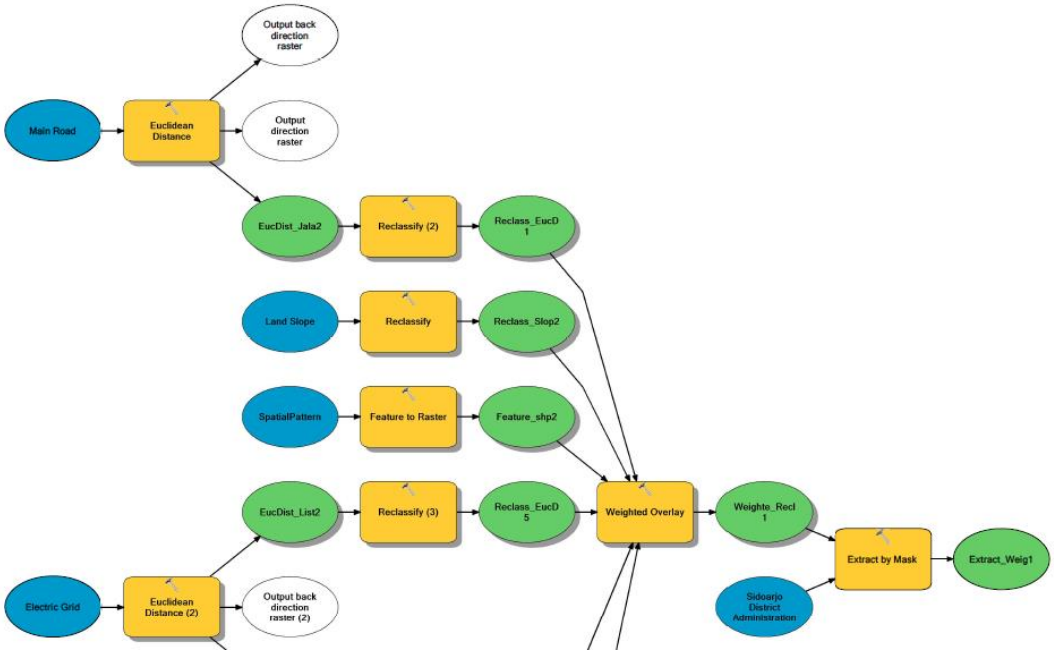


Figure 5. 10 Model Builder

Figure 5. 11 Model Builder (Con't)

After all the layers of criteria are already digitized, the spatial analysis process is beginning by processing each layer. The first spatial analyst tool to be used in this process is Euclidean distance tool. Euclidean Distance is used to develop buffer area or Euclidean space. The basis for the Euclidean Distance tool or process is obtained from the application of the Pythagorean theorem which was introduced to calculate the distance between points in one dimension to three dimensions in the case that was run in the Geographic Information System. The tools are also important for the purposes of measuring distances in navigation. In this research, the Euclidean Distance tool will be used to four criteria layer which are distance to main road, distance to electric grid, distance to health facilities, and distance to educational activities. The following is an example of the steps for using the Euclidean Distance Tool in this study.

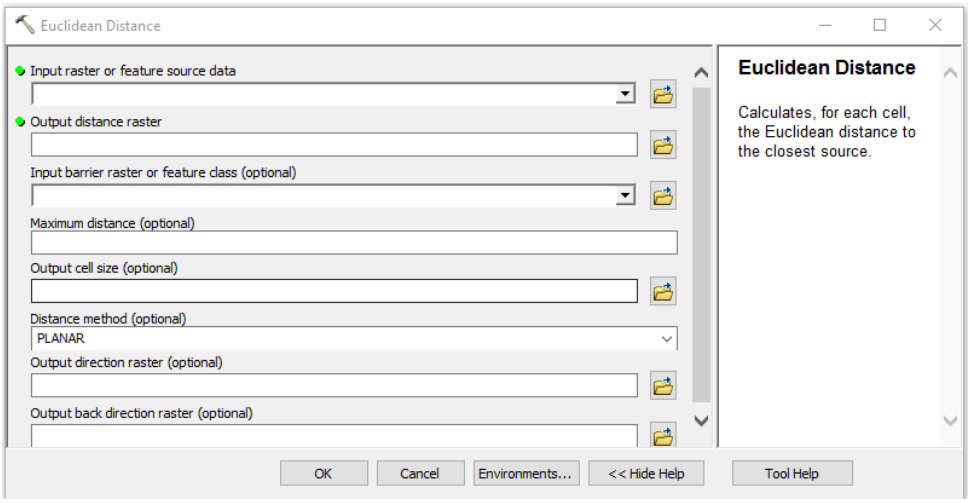


Figure 5. 12 Dialog box of Euclidean Distance Tool in ArcGIS

The first step in performing Euclidean Distance is of course choosing what criteria to add to the buffer area. This step is carried out in the "Input Raster or Feature Source Data" column. It should be reminded that at this stage the data type used must be raster data. After filling in the raster data, the destination file location will automatically appear by default. When the output file location appears, then author fill in the Maximum Distance as the maximum area of the buffer area. The example results of process using Euclidean Distance Tool can be seen in the Figure 5.17.

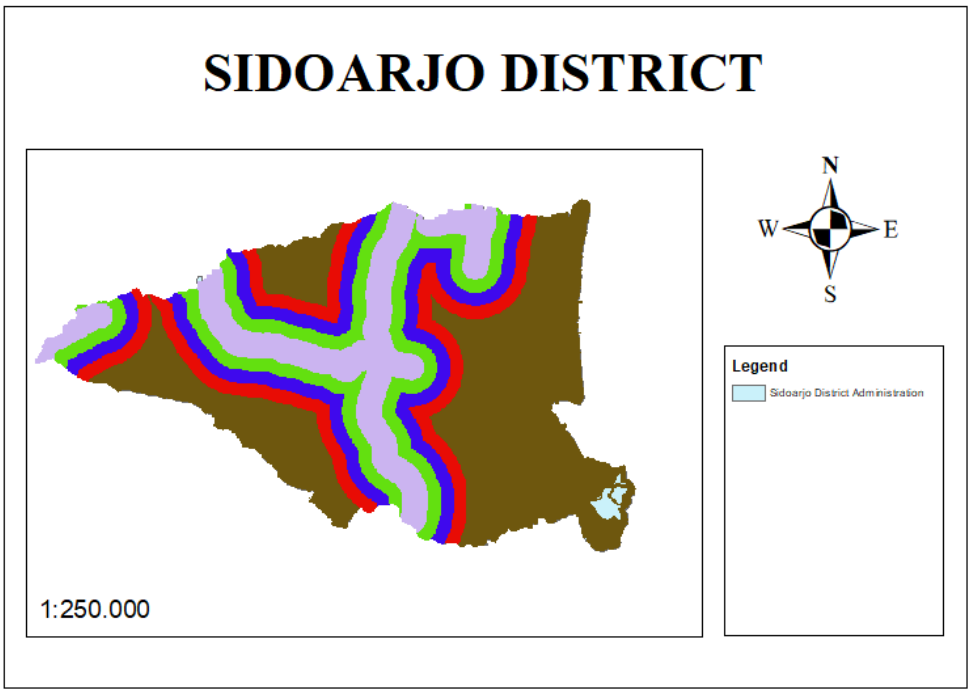


Figure 5. 13 Euclidean Distance Result of Main Road

These results indicate that the process of using the Euclidean Distance tool has been carried out so that it can be continued for the next process which is the process of classifying the newly emerged area or categorizing/creating a class on the buffer area using a tool called Reclassify.

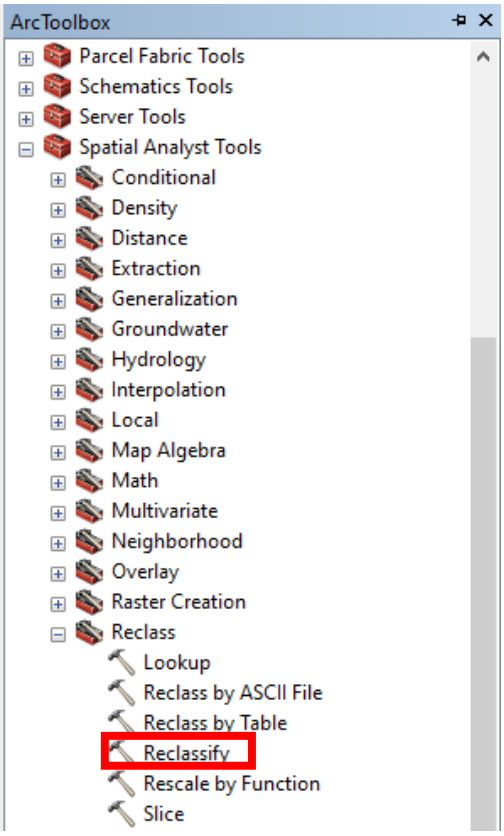


Figure 5. 14 Reclassify Tool in ArcGIS

Class division in the buffer area is intended to provide a detailed assessment per condition of distance from an area so that the assessment to determine the project location can be more comprehensive. The class division is adjusted to the spatial pattern of Sidoarjo District and based on the discussion result of author and PT. X. The following is the class division of buffer area in this research.

Table 5. 6 Class Division of Buffer Area

Parameter	Class	Description
Distance to Main Road	1	< 1 Km
	2	1 - 2 Km
	3	2 - 3 Km
	4	3 - 4 Km
	5	> 4 Km
Land Slope	1	0% - 2%
	2	2% - 8%
	3	8% - 15%
Distance to Electric Grid	1	< 300 m
	2	300 - < 600 m

Table 5. 6 Class Division of Buffer Area

Parameter	Class	Description
	3	600 - < 1000 m
	4	1000 - < 1500 m
	5	> 1500 m
Distance to Health Facility	1	< 750 m
	2	750 - < 1500 m
	3	1500 - < 2500 m
	4	2500 -< 5000 m
	5	> 5000 m
Distance to Education Facility	1	< 750 m
	2	750 - < 1500 m
	3	1500 - < 2500 m
	4	2500 -< 5000 m
	5	> 5000 m

From the six criteria used in the study, five of them have their own class divisions based on distance or based on the percentage of slope for the slope criteria. The maximum distance in a class is also the basic data for the previous process in determining the maximum limit in the Euclidean Distance process. The following is the example of Reclassify process in this research.

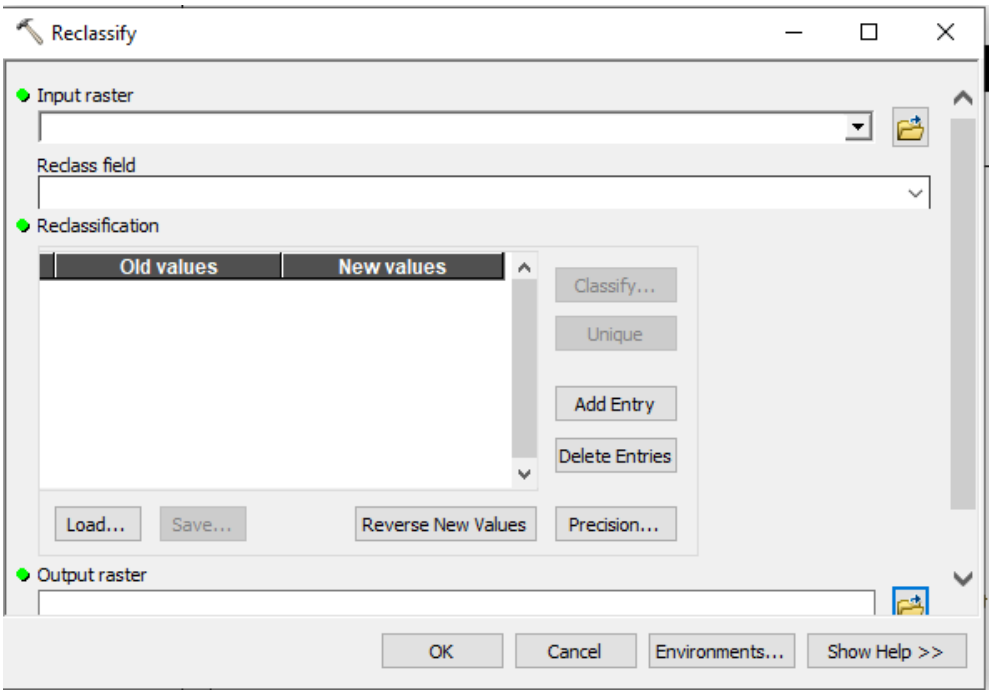


Figure 5. 15 Dialog Box of Reclassify Tool on ArcGIS

At this stage, the raster data that will be input is Euclidean Distance data obtained from the previous process. Then to do the class division can be done by pressing the Classify button in the dialog box. Once pressed, a new box will appear which will state that the class division will be done manually or automatically while if it is done manually, it will be divided into a certain number of classes such as in the Figure 5.20.

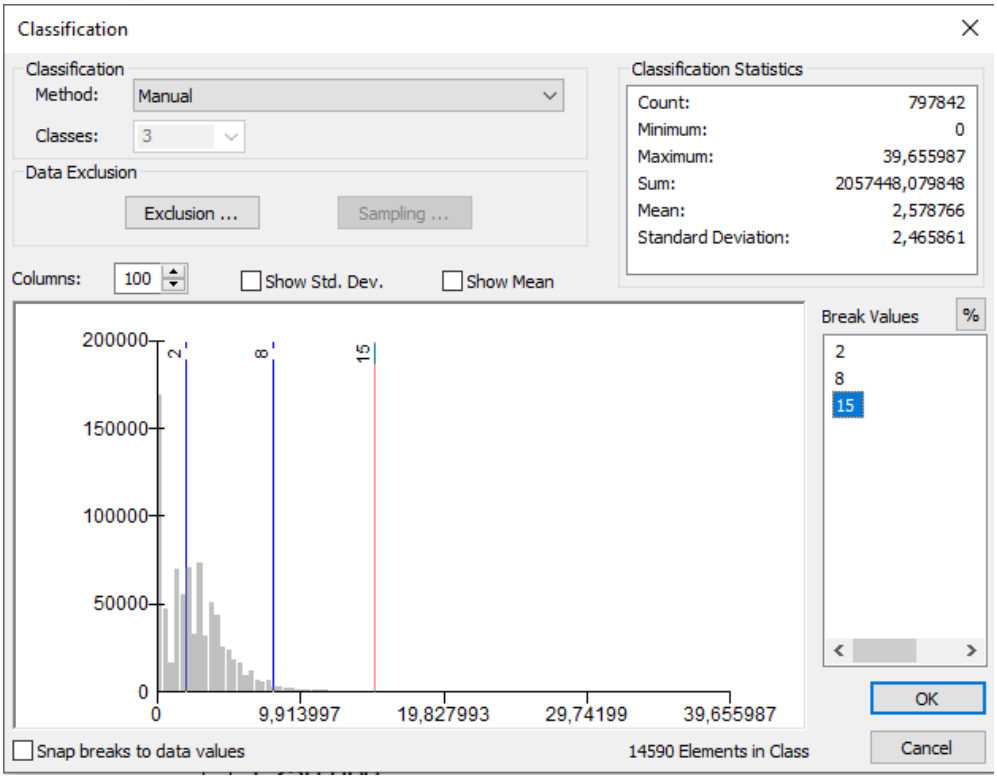


Figure 5. 16 Dialog Box of Class Division on Reclassify Tool

This process is carried out for the five existing criteria, so that at this point the Reclassify process has been completed and can be continued with the most important process in this study, which is related to the weighting of each region in Sidoarjo District through various digital data combined with each other. The next process is to do a Weighted Overlay with a tool that is in the same category as the two previous tools, which is under the Spatial Analyst Tool as can be seen in the Figure 5.21.

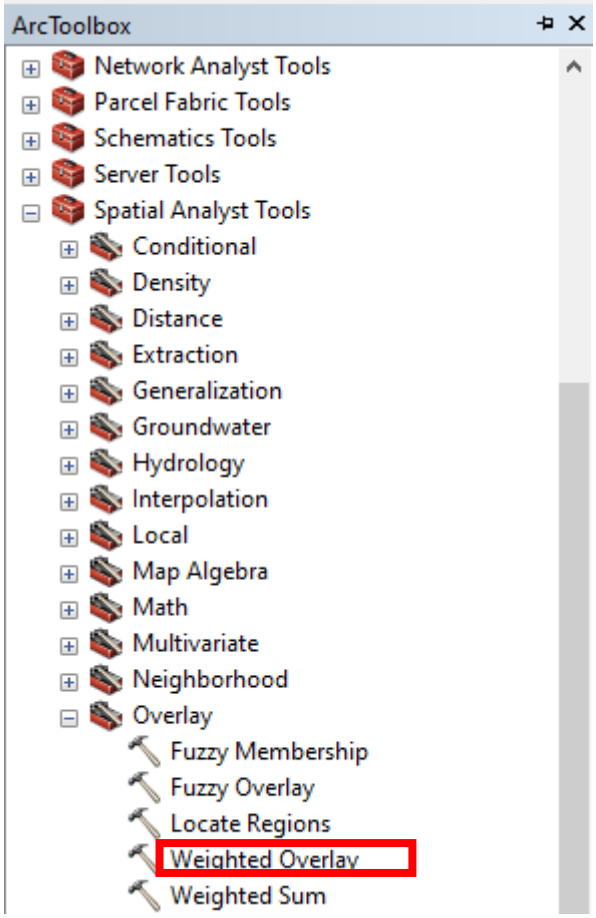


Figure 5. 17 Weighted Overlay Tools in ArcGIS

To conduct the Weighted Overlay Tool, the data of AHP result in the previous subchapter is needed as the input of this tool. From the results of the AHP, each value of the level of importance or in ArcGIS is known as %influence which is useful as a determinant of the level of interest in a set of selected indicators. The detailed values of Weighted Overlay data input can be seen in the Table 5.6.

Table 5. 7 Input Recapitulation for Weighted Overlay Tool

PARAMETER	CLASS	Description	Influence	Value
Distance to Main Road	1	< 1 Km	26%	9
	2	1 - 2 Km		7
	3	2 - 3 Km		5
	4	3 - 4 Km		3
	5	> 4 Km		1
Land Slope	1	0% - 2%	3%	9
	2	2% - 8%		5

Table 5. 7 Input Recapitulation for Weighted Overlay Tool

PARAMETER	CLASS	Description	Influence	Value
	3	8% - 15%		1
Distance to Electric Grid	1	< 300 m	6%	9
	2	300 - < 600 m		7
	3	600 - < 1000 m		5
	4	1000 - < 1500 m		3
	5	> 1500 m		1
Distance to Health Facility	1	< 750 m	13%	9
	2	750 - < 1500 m		7
	3	1500 - < 2500 m		5
	4	2500 -< 5000 m		3
	5	> 5000 m		1
Distance to Education Facility	1	< 750 m	9%	9
	2	750 - < 1500 m		7
	3	1500 - < 2500 m		5
	4	2500 -< 5000 m		3
	5	> 5000 m		1
Spatial Pattern of Sidoarjo District	Industry		43%	RESTRICTED
	Airport			RESTRICTED
	Protected			RESTRICTED
	Trading			RESTRICTED
	Settlement			9
	Agriculture			RESTRICTED

The Weighted Overlay process is done by summation of influence of each criterion multiplied by the value of the criteria in the grid. Therefore, formula of calculating one grid of map using weighted overlay tools is as follow.

$$
\begin{aligned}
Weighted\ Overlay \\
&= (Criteria\ 1\ Value\ \times Criteria\ 1\ Influence) \\
&+ (Criteria\ 2\ Value\ \times Criteria\ 2\ Influence) \\
&+ (Criteria\ 3\ Value\ \times Criteria\ 3\ Influence) \\
&+ (Criteria\ 4\ Value\ \times Criteria\ 4\ Influence) \\
&+ (Criteria\ 5\ Value\ \times Criteria\ 5\ Influence) \\
&+ (Criteria\ 6\ Value\ \times Criteria\ 6\ Influence)
\end{aligned}
$$

The Data Export process is a minor process that can be done after making a weighted map where the purpose of this process is only to convert data types. Then the next process that can be done on this ArcGIS software is Extraction by Mask which is also in the Spatial Analyst Tool category. This process aims to cut layers with other layers precisely. As in this case, a map that has been weighted with a map of the administrative boundaries of Sidoarjo District will be cut. This is very useful because instead of the area that is carried out by Euclidean distance, there will certainly be outside the administrative boundaries, therefore there is a need for a masking process in the map making process to make it more relevant to apply. The masking process takes place by selecting the raster input data to be masked with the appropriate raster data to limit the raster data as can be seen in the Figure 5.22.

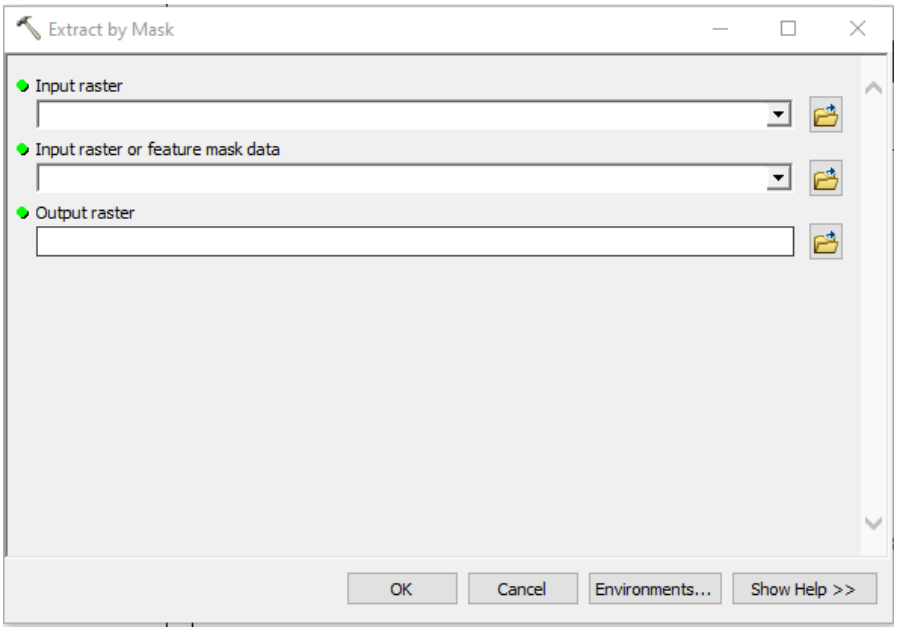


Figure 5. 18 Dialog Box of Extract by Mast Tool on ArcGIS

With the Extract by Mask process is finished, it means that the weighted overlay map which shows the priority location for housing development is already done. The final map of the weighted map can be seen in the Figure 5.23.

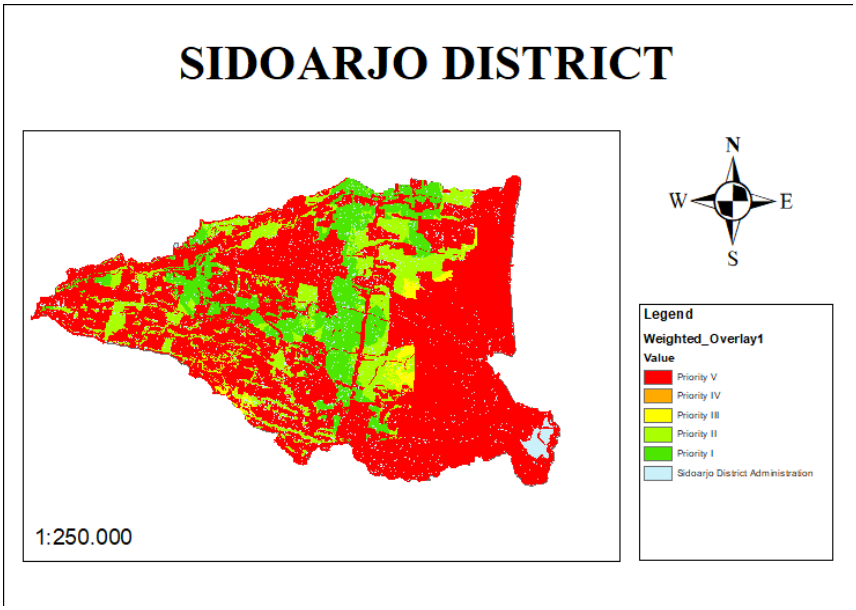


Figure 5. 19 Weighted Map of Priority Location

In the figure above, the red color shows the lowest priority value which is Priority V, the orange color shows Priority IV, the yellow color shows Priority III,

the light green color shows Priority II, and the dark green color shows the highest priority value which is Priority I. The priority areas are determined based on the value of a certain area. The detailed description can be seen in Table 5.7.

Table 5. 8 Priority Area Value

Priority	Value
Priority I	8-9
Priority II	6-7
Priority III	4-5
Priority IV	2-3
Priority V	0-1

5.6 Analysis of Priority Location

In this research, the result of weighted map using ArcGIS is divided into five classes, which are Priority I, Priority II, Priority III, Priority IV, and Priority V. Factors that affected the priority determination is the %influence or the result of the AHP calculation. There are six criteria, which are distance to main road, land slope, distance to electric grid, distance to health facilities, distance to educational facilities, and spatial pattern of Sidoarjo District.

The most influential criteria are spatial pattern of Sidoarjo District, with 43% of influence compared to other criteria. The reason why spatial pattern has the biggest influence is because the local regulation of Sidoarjo District that states all housing development projects can only be built in the settlement area. In this research, the spatial pattern is divided into six classes, which are airport, industry, protected, trading, settlement, agriculture, and others. Since the housing development project only can be built in the settlement areas, therefore the other classes are considered restricted and will be shown in the map as zero value or the lowest priority with the red color. Meanwhile, the land slope has the least influence compared to the other criteria with the value of 3%. Actually, taking account into the land slope is quite important in the planning of housing development, because if the land slope is greater than 15%, the risk of landslide is more likely to happen. Fortunately, Sidoarjo District has a land profile that tends to be flat because Sidoarjo District happens to be located in the lowland, so the risk of landslide is not really worrisome.

Table 5. 9 Area of Each Priority

Priority	Area (km2)
Priority I	76,27956987
Priority II	83,40263089
Priority III	9,582059225
Priority IV	0
Priority V	423,7288215

As can be seen in the table above, the majority of the map is in the red color which is Priority V as it has the biggest area with 432,73 km^2. That is because based on the spatial pattern of Sidoarjo District, the majority of the area is devoted to certain interests or indeed there are natural objects that should be preserved and not suitable for settlement.

Based on the weighted overlay result, it can be found that among the four locations proposed for the housing development project, there is one location that is in Priority I, which is location 4. In Priority II, there is one location which is location 2. In Priority III, there is one location which is location 1. Meanwhile for the remaining location which is location 3, happens to be placed in Priority V. Because based on the spatial pattern map, the land is located in the industry area instead of settlement area. Therefore, the land is considered out of place so it is located in the Priority V area.

In this research, the feasibility analysis will be done to two location alternatives that has highest value of priority based on the result of the spatial analysis. Two locations will be selected so that PT. X may have comparison of feasibility result from two locations, hence if the feasibility result from location alternative with highest value of priority is not feasible, there is still another location alternative feasibility analysis as comparison analysis. Based on the result, the selected priority location is the Location 4 which located in Priority I area. While for the following process, financial modelling, the location selected is location 4 and location 2 which located in Priority II area.

CHAPTER 6
FEASIBILITY ANALYSIS

This chapter will consist of information about data collection and processing steps that will be done by the author in doing feasibility analysis of the property business development. After the data collection and processing steps are done, the data analysis and interpretation are also done in this chapter regarding the feasibility analysis.

6.1 Data Collection

In subchapter 6.1, there will be an information about required data for conducting further process of this research. The data used to include supporting financial data such as inflation and historical data of stock price. Other than that, initial data formulation that used as base for financial modelling and feasibility study also includes in this subchapter.

6.1.1 Inflation

The inflation rate of a nation is usually set by a monetary authority organization or a central bank. The central bank of Indonesia is Bank Indonesia, so the role of setting inflation rate in Indonesia is done by Bank Indonesia. They set target levels of inflation rate periodically, commonly three years, and maintain its volatility time by time by implementing monetary policy. Based on Proturan Menteri Keuangan No. 124/PMK.010/2017 for the period of 2019-2021, the 2021 inflation target level is targeted at 3% with a deviation of 1%. This target will be used as a fixed inflation rate for the time horizon in this research's financial modelling and feasibility study.

6.1.2 Planning Horizon Determination

The determination of planning horizon is the process of determining time horizon used in the financial modelling and feasibility study process. In this research, the planning horizon is starting from 2020, and will ends along with the construction process of the housing development. Housing development project

usually lasts for approximately 10 years depends on the land area of the project. In this research, the maximum time for the time horizon is 2055, but the project may be finished in between the time horizon.

6.1.3 WACC Calculation

The Weighted Average Cost of Capital calculation is done by considering two components which are cost of equity and cost of debt. The formula of calculating WACC can be seen in Formula 2.22, and also shown below.

$$WACC = \left(\frac{E}{E+D}\right) R_E + \left(\frac{D}{E+D}\right) R_D$$

Where,

WACC : Weighted Average Cost of Capital

E : Amount of capital sourced from equity

D : Amount of capital sourced from debt

R_E : Cost of Equity

R_D : Cost of Debt

There are many variables needed in order to calculate WACC. In this research, those variables are already obtained from previous research. The value of each component can be seen in the Table 6.1.

Table 6. 1 Components Variables of WACC

Component	Value	Description
Risk Free Rate (Rf)	7,06 %	Indonesia Government Bond 30 Year (GIDN30YR Index)
Risk Premium Market (Rpm)	4,88 %	Market Risk Premium in Indonesia
Unlevered Beta	0,53	Average Unlevered Beta of 15 Benchmarked Industry
Alpha	3,00 %	The amount that the investment has returned in comparison to the market index or other broad benchmark
Interest Rate	8,77 %	Interest Rate of Investment Loan by State Banks
Tax Rate	2,50 %	Final Tax Rate of the Company (Interview with PT. X)

The first step of conducting the calculation of WACC is to calculate the cost of equity (R_E). The R_E will be calculated using CAPM method as can be seen in formula below.

$$R_E = Rf + (\beta \times R_{pm}) + \alpha$$

Where,

R_E : Cost of equity

Rf : Risk free rate

Rpm : Market risk premium

β : Un-diversifiable risk of stock relative to market return

α : Excess return of an investment relative to the return of a benchmark index

The levered beta calculation for the proposed industry is conducted based on the obtained average unlevered beta from benchmarked industries using the formula below.

$$Relevered\ \beta = Average\ Unlevered\ \beta\ \times (1 + ((1 - t) \times DER)$$

Where,

t : Tax Rate

DER : Proposed Industry DER

The debt-to-equity ratio used in this formula will be inputted according to the proposed industry capital structure assumption used in this research which consists of 30% debt to 70% equity or equal to 0.43. The calculation of the relevered beta can be seen below.

$$Relevered\ \beta = 0{,}53\ \times (1 + ((1 - 2.5\%) \times 0.43)$$

$$Relevered\ \beta = 0.76$$

From the data acquired, the cost of equity of the proposed industry can be calculated as follow.

$$R_E = 7.06\% + (0.76 \times 4.88\%) + 3\%$$
$$R_E = 13.74\%$$

The next step of calculating WACC is to calculate the cost of debt which follow formula below.

$$R_D = R_{DBT}(1 - T)$$

Where,

R_D : Cost of Debt

R_{DBT} : Loan interest rate before tax implementation

T : Tax Rate

Using the formula above, the calculation of cost of debt of the proposed industry can be calculated as follow:

$$R_D = 8.77\% \times (1 - 2.5\%)$$
$$R_D = 8.55\%$$

The last step of the WACC calculation is to calculate the weighted average of the cost of equity and cost of debt according to its capital structure assumption.

$$WACC = \left(\frac{E}{E + D}\right) R_E + \left(\frac{D}{E + D}\right) R_D$$
$$WACC = (70\%) \times 13.74\% + (30\%) \times 8.55\%$$
$$WACC = 12.19\%$$

Based on the calculation, it is obtained that the WACC value for the proposed industry is 12.19%. The value will be used for further process in calculating financial parameters in the last step of feasibility analysis.

6.1.4 Financial Model Micro and Macro Assumption Determination

In order to build proposed business plan financial model and feasibility study, several micro and macro assumptions is needed. The detailed information about the assumptions can be seen in the Table 6.2.

Table 6. 2 Macro Assumption of Financial Model

Macro Assumption	Value	Information
Economic Growth	5%	
Inflation	3%	Fixed per year based on BI target
Exchange Rate USD => Rp	14.400	Indonesia to USD Exchange Rate Historical Data (March 2021)
Initial Year	2020	
Selling Price Growth Rate	5%	Obtained by Interview with PT. X
Cost Growth Rate	5%	
Tenor	5	
Interest Rate	11,25%	
Provision	1%	
Income Tax	2,5%	
Discount Factor	12%	

Table 5. 10 Micro Assumption of Financial Model

Micro Assumption	Value
Construction Cost per m2	Rp 2.500.000
Construction Cost Growth Rate	2%
Land Finishing Cost per m2	Rp 120.000
Land Price Growth Rate	0%
G&A Expenses	5%
Marketing Expenses	5%
Location 2	
Land Area	610.000
Land Price	Rp 250.000
Number of Houses	
Type 36	720
Type 45	124
Type 55	96
House Price	
Type 36	Rp 420.000.000
Type 45	Rp 450.000.000
Type 55	Rp 500.000.000

Table 5. 10 Micro Assumption of Financial Model

Micro Assumption	Value
Land Area (m^2)	
Type 36	72
Type 45	90
Type 55	105
Building Area (m^2)	
Type 36	36
Type 45	45
Type 55	55
Location 4	
Land Area	250.000
Land Price	Rp 100.000
Number of Houses	
Type 50	64
Type 70	263
Type 90	98
Type 95	64
Type 170	218
Type 150	42
House Price	
Type 50	Rp 300.000.000
Type 70	Rp 400.000.000
Type 90	Rp 500.000.000
Type 95	Rp 600.000.000
Type 170	Rp 800.000.000
Type 150	Rp 1.000.000.000
Land Area (m^2)	
Type 50	90
Type 70	120
Type 90	120
Type 95	120
Type 170	85
Type 150	75
Building Area (m^2)	
Type 50	50
Type 70	70
Type 90	90
Type 95	95
Type 170	170
Type 150	150

All of the micro assumption above is based on the interview with the project developer which is PT. X.

6.2 Data Processing

In this subchapter, there will be an information about data processing of feasibility analysis, includes business plan of the property development, financial modelling and feasibility analysis of each location, and sensitivity analysis of selected location.

6.2.1 Business Plan of Property Business Development

This process is done in order to explain the detailed information about the location alternatives which are location 4 and location 2.

1. Location 4

In this location alternative, PT. X as the developer will build 6 (six) types of houses as an alternative for consumers which are type 50, type 70, type 90, type 95, type 170, and type 150. The specification of each type will be explained in the following passages.

a. Type 50/90

Building area	: 50 m^2
Land area	: 90 m^2
Selling price	: Rp 300.000.000
Number of floors	: 1 floor

b. Type 70/120

Building area	: 70 m^2
Land area	: 120 m^2
Selling price	: Rp 400.000.000
Number of floors	: 1 floor

c. Type 90/120

Building area	: 90 m^2
Land area	: 120 m^2
Selling price	: Rp 400.000.000
Number of floors	: 1 floor

d. Type 95/120

Building area	: 95 m^2

Land area : 120 m^2

Selling price : Rp 500.000.000

Number of floors : 1 floor

e. Type 170/85

Building area : 170 m^2

Land area : 85 m^2

Selling price : Rp 800.000.000

Number of floors : 2 floors

f. Type 150/75

Building area : 150 m^2

Land area : 75 m^2

Selling price : Rp 1.000.000.000

Number of floors : 2 floors

Other than the houses, to provide comfort for residents of housing, this housing is equipped with various facilities, both public facilities and social facilities, such as paving roads, waterways, burial ground, garbage dumps, park and green open spaces, and street lightings. In this research the process of building the facilities will be considered as Capital Expenditure (CAPEX). The recapitulation of CAPEX calculation will be explained in the following passages.

a. Land acquisition

Land price per m^2 = Rp 100.000

Land area = 250.000 m^2

Effective land area = 60% x 250.000 m^2

= 150.000 m^2

Public facilities land area = 40% x 250.000 m^2

= 100.000 m^2

Total land price = Rp 100.000 x 250.000

= Rp 25.000.000.000

b. Road construction cost

Road area (m^2) = 22.5% x 250.000 m^2

= 56.250 m^2

Paving cost per m^2 = Rp 100.000

Road construction cost	= 56.250 m^2 x Rp 100.000
	= Rp 5.625.000.000

c. Waterways construction cost

Total of waterways (m)	= 6 m x Total house built
	= 4.494 m
Waterway cost per m	= Rp 200.000
Waterways cost	= 4.494 m x Rp 200.000
	= Rp 898.800.000

d. Garbage dump construction cost

Garbage dump area	= 80 m^2
Land cost	= Rp 100.000 x 80
	= Rp 8.000.000
Building cost	= Rp 2.500.000 x 80
	= Rp 200.000.000
Machine and equipment	= Rp 25.000.000
Others	= Rp 10.000.000
Total cost	= Rp 243.000.000

e. Burial ground cost

Land area	= 2% x 250.000 m^2
	= 5.000 m^2
Burial ground cost	= Rp 100.000 x 5.000
	= Rp 500.000.000

f. Park and green open spaces cost

Land area	= 17.5% x 250.000 m^2
	= 39.256 m^2
Construction cost per m^2	= Rp 170.000
Total cost	= Rp 170.000 x 39.256 m^2
	= Rp 6.673.520.000

g. Street lightings

Number of lightings	= Number of house built / 8
	= 94 poles
Cost per pole	= Rp 3.500.000

Total cost = Rp 3.500.000 x 94

= Rp 327.687.500

h. Land cut and fill cost

Total land = 105.174 m^2

Land cut and fill per m^2 = Rp 120.000

Total cost = Rp 120.000 x 105.174 m^2

= Rp 12.620.835.000

The investment for land and public facilities will be considered as CAPEX. The recapitulation of the CAPEX calculation will be shown in the Table 6.3.

Table 6. 3 CAPEX Schedule for Location 4

Item	Investment	Construction Start	Duration	Construction Finish	2021	2022
Landbank	Land				100 %	
Infrastructure	Road	2021	2	2023	50 %	50 %
	Waterways	2021	2	2023	50 %	50 %
	Garbage Dump	2021	2	2023	50 %	50 %
Facilities	Burial Ground	2021	2	2023	50 %	50 %
	Park and Green Open Spaces	2021	2	2023	50 %	50 %
Utilities	Street Lightings	2021	2	2023	50 %	50 %
	Land Cut and Fill	2021	1	2022	100 %	

Table 6. 4 CAPEX Recapitulation for Location 4

Item	Investment	Total Investment	2021	2022
Landbank	Land	Rp 25.000.000.000	Rp 25.000.000.000	Rp -
Infrastructure	Road	Rp 5.625.000.000	Rp 2.812.500.000	Rp 2.812.500.000
	Waterways	Rp 898.800.000	Rp 449.400.000	Rp 449.400.000
	Garbage Dump	Rp 243.000.000	Rp 121.500.000	Rp 121.500.000
Facilities	Burial Ground	Rp 500.000.000	Rp 250.000.000	Rp 250.000.000
	Park and Green Open Spaces	Rp 6.673.520.000	Rp 3.336.760.000	Rp 3.336.760.000
Utilities	Street Lightings	Rp 327.687.500	Rp 163.843.750	Rp 163.843.750

Table 6. 4 CAPEX Recapitulation for Location 4

Item	Investment	Total Investment	2021	2022
	Land Cut and Fill	Rp 12.620.835.000	Rp 12.620.835.000	Rp -
TOTAL		**Rp 51.888.842.500**	**Rp 44.754.838.750**	**Rp 7.134.003.750**

After the CAPEX is already determined, the next component to be decided is Operational Expenditure (OPEX). In this research, the OPEX consists of three components, which are Cost of Goods Sold (COGS), marketing expense, and general and administrative expense. The calculation of each component will be shown in the following passages.

a. Cost of Goods Sold (COGS)

In this research, the cost of building a house from the land clearing process until the house is built is considered as COGS. Therefore, the formula to calculate the COGS is:

$$COGS = (Number\ of\ Houses\ Built\ \times Building\ Area \times Construction\ Cost\ per\ m^2) + (Number\ of\ Houses\ Built\ \times Land\ Area \times Land\ Cut\ and\ Fill\ Cost\ per\ m^2)$$

b. Marketing expenses

Marketing expenses is an amount of money the company spends on marketing. In this research, marketing expenses is determined by 5% from the total sales.

c. General and Administrative expenses

G&A expenses is day-to-day costs a business must pay to operate or generate value. In this research, G&A expenses is also determined by 5% from the total sales.

Based on the explanation in the previous passages, the recapitulation of OPEX will be shown in the Table 6.5.

Table 6. 5 Total OPEX/Year for Location 4 (in IDR, million)

OPEX	in million						
	2021	2022	2023	...	2037	2038	2039
Cost of Goods Sold	Rp -	Rp -	Rp 1.858		Rp 30.133	Rp 26.956	Rp 3.995
G&A Expenses	Rp 202	Rp 1.371	Rp 2.007		Rp 684	Rp -	Rp -
Marketing Expenses	Rp 202	Rp 1.371	Rp 2.007		Rp 684	Rp -	Rp -
Total OPEX/Year	**Rp 404**	**Rp 2.742**	**Rp 5.872**		**Rp 31.501**	**Rp 26.956**	**Rp 3.995**

2. Location 2

In this location alternative, PT. X as the developer will build 3 (three) types of houses as an alternative for consumers which are type 36, type 45, and type 55. The specification of each type will be explained in the following passages.

a. Type 36/72

Building area : 36 m^2

Land area : 72 m^2

Selling price : Rp 420.000.000

Number of floors : 1 floor

b. Type 45/90

Building area : 45 m^2

Land area : 90 m^2

Selling price : Rp 450.000.000

Number of floors : 1 floor

c. Type 55/105

Building area : 55 m^2

Land area : 105 m^2

Selling price : Rp 500.000.000

Number of floors : 1 floor

Similar to the previous location, other than the houses, to provide comfort for residents of housing, this housing is equipped with various facilities, both public facilities and social facilities, such as paving roads, waterways, burial ground,

garbage dumps, park and green open spaces, and street lightings. In this research the process of building the facilities will be considered as Capital Expenditure (CAPEX). The recapitulation of CAPEX calculation will be explained in the following passages.

a. Land acquisition

Land price per m^2	= Rp 250.000
Land area	= 610.000 m^2
Effective land area	= 60% x 610.000 m^2
	= 366.000 m^2
Public facilities land area	= 40% x 610.000 m^2
	= 244.000 m^2
Total land price	= Rp 250.000 x 610.000
	= Rp 152.500.000.000

b. Road construction cost

Road area (m^2)	= 22.5% x 610.000 m^2
	= 137.250 m^2
Paving cost per m^2	= Rp 100.000
Road construction cost	= 56.250 m^2 x Rp 100.000
	= Rp 13.725.000.000

c. Waterways construction cost

Total of waterways (m)	= 6 m x Total house built
	= 5.640 m
Waterway cost per m	= Rp 200.000
Waterways cost	= 5.640 m x Rp 200.000
	= Rp 1.128.000.000

d. Garbage dump construction cost

Garbage dump area	= 80 m^2
Land cost	= Rp 250.000 x 80
	= Rp 20.000.000
Building cost	= Rp 2.500.000 x 80
	= Rp 200.000.000
Machine and equipment	= Rp 25.000.000

Others = Rp 10.000.000

Total cost = Rp 255.000.000

e. Burial ground cost

Land area = 2% x 610.000 m^2

= 12.200 m^2

Burial ground cost = Rp 250.000 x 12.200

= Rp 3.050.000.000

f. Park and green open spaces cost

Land area = 17.5% x 250.000 m^2

= 101.110 m^2

Construction cost per m^2 = Rp 170.000

Total cost = Rp 170.000 x 101.110 m^2

= Rp 17.188.700.000

g. Street lightings

Number of lightings = Number of house built / 8

= 192 poles

Cost per pole = Rp 3.500.000

Total cost = Rp 3.500.000 x 192

= Rp 672.000.000

h. Land cut and fill cost

Total land = 256.280 m^2

Land cut and fill per m^2 = Rp 120.000

Total cost = Rp 120.000 x 256.280 m^2

= Rp 30.753.600.000

The investment for land and public facilities will be considered as CAPEX. The recapitulation of the CAPEX calculation will be shown in the Table 6.6.

Table 6. 6 CAPEX Schedule of Location 2

Item	Investment	Construction Start	Duration	Construction Finish	2021	2022
Landbank	Land				100 %	
Infrastructure	Road	2021	2	2023	50 %	50 %
	Waterways	2021	2	2023	50 %	50 %

Table 6. 6 CAPEX Schedule of Location 2

Item	Investment	Construction Start	Duration	Construction Finish	2021	2022
	Garbage Dump	2021	2	2023	50 %	50 %
Facilities	Burial Ground	2021	2	2023	50 %	50 %
	Park and Green Open Spaces	2021	2	2023	50 %	50 %
Utilities	Street Lightings	2021	2	2023	50 %	50 %
	Land Cut and Fill	2021	1	2022	100 %	

Table 6. 7 CAPEX Recapitulation for Location 2

Item	Investment	Total Investment	2021	2022
Landbank	Land	Rp 152.500.000.000	Rp 152.500.000.000	Rp -
Infrastructure	Road	Rp 13.725.000.000	Rp 6.862.500.000	Rp 6.862.500.000
	Waterways	Rp 1.128.000.000	Rp 564.000.000	Rp 564.000.000
	Garbage Dump	Rp 255.000.000	Rp 127.500.000	Rp 127.500.000
Facilities	Burial Ground	Rp 3.050.000.000	Rp 1.525.000.000	Rp 1.525.000.000
	Park and Green Open Spaces	Rp 17.188.700.000	Rp 8.594.350.000	Rp 8.594.350.000
Utilities	Street Lightings	Rp 672.000.000	Rp 336.000.000	Rp 336.000.000
	Land Cut and Fill	Rp 30.753.600.000	Rp 30.753.600.000	Rp -
TOTAL		**Rp 219.272.300.000**	**Rp 201.262.950.000**	**Rp 18.009.350.000**

Similar to previous location, after the CAPEX is already determined, the next component to be decided is Operational Expenditure (OPEX). In this research, the OPEX consists of three components, which are Cost of Goods Sold (COGS), marketing expense, and general and administrative expense. The calculation of each component will be shown in the following passages.

a. Cost of Goods Sold (COGS)

In this research, the cost of building a house from the land clearing process until the house is built is considered as COGS. Therefore, the formula to calculate the COGS is:

$$COGS = (Number\ of\ Houses\ Built\ \times Building\ Area \times Construction\ Cost\ per\ m^2) + (Number\ of\ Houses\ Built\ \times Land\ Area \times Land\ Cut\ and\ Fill\ Cost\ per\ m^2)$$

b. Marketing expenses

Marketing expenses is an amount of money the company spends on marketing. In this research, marketing expenses is determined by 5% from the total sales.

c. General and Administrative expenses

G&A expenses is day-to-day costs a business must pay to operate or generate value. In this research, G&A expenses is also determined by 5% from the total sales.

Based on the explanation in the previous passages, the recapitulation of OPEX will be shown in the Table 6.8.

Table 6. 8 Total OPEX/Year for Location 2

OPEX	in million						
	2021	**2022**	**2023**	**...**	**2028**	**2029**	**2030**
Cost of Goods Sold	Rp -	Rp -	Rp 15.194		Rp 7.114	Rp 7.279	Rp 3.611
G&A Expenses	Rp 3.175	Rp 3.334	Rp 4.147		Rp 709	Rp -	Rp -
Marketing Expenses	Rp 3.175	Rp 3.334	Rp 4.147		Rp 709	Rp -	Rp -
Total OPEX/Year	**Rp 6.350**	**Rp 6.668**	**Rp 23.488**		**Rp 8.532**	**Rp 7.279**	**Rp 3.611**

6.2.2 Financial Modelling and Feasibility Analysis

The financial modelling and feasibility analysis in this research will be done for each location alternatives. The detail calculation for each BPS will be explained in this subchapter.

1. Financial Modelling and Feasibility Analysis of Location 4

First thing needed to be calculated in this financial modelling is the funding of the project. Based on the information taken from PT. X, the funding of the project

will be funded with a proportion of 30%:70% of bank loan and self-funding. The proportion for this location alternative can be seen in the Table 6.9.

Table 6. 9 Location 4 - Debt to Equity Ratio

Funding	%	Total Investment
Bank Loan	30%	Rp 15.566.652.750
Self-Funding	70%	Rp 36.322.189.750
Total		**Rp 51.888.842.500**

The total funding in the table above will be allocated into CAPEX component that already shown in the Table 6.4. In this research, the bank loan is using 2 years of grace period and tenor of 5 years. The loan drawdown will be divided into 3 periods from 2020-2022. The first period loan drawdown will be used for land acquisition. The second and third period of loan drawdown will be allocated to the investment in public facilities and social facilities. The recapitulation of loan drawdown for each period will be shown in the Table 6.10.

Table 6. 10 Location 4 - Loan Drawdown

Loan Drawdown	Tenor	Grace Period	Total Drawdown
2020 Loans	5	2	Rp 7.500.000.000
2021 Loans	5	2	Rp 5.926.451.625
2022 Loans	5	2	Rp 2.140.201.125

The calculation for loan installment during each period can be done in Ms. Excel using formula below.

$$Installment\ for\ Loan\ Drawdown_t = \frac{l_t}{T}$$

Where,

t : t Period during Construction

l_t : Loan drawdown on t Period during Construction

T : Debt tenor

Using the formula above, it can be calculated as follow:

$$Installment\ for\ Loan\ Drawdown_{2020} = \frac{Rp\ 7.500.000}{5}$$

$$Installment\ for\ Loan\ Drawdown_{2020} = Rp\ 1.500.000.000$$

The calculation above also used for each drawdown in every period. The recapitulation of the calculation will be shown in the Table 6.11.

Table 6. 11 Location 4 - Debt Repayment Schedule (in million)

Debt Schedule	2020	2021	2022	...	2027	2028
Loan Initial Balance	Rp -	Rp 7.500	Rp 13.426		Rp -	Rp 428
Loan Drawdown	Rp 7.500	Rp 5.926	Rp 2.140		Rp -	Rp -
Installment 1	Rp -	Rp -	Rp 1.500		Rp -	Rp -
Installment 2	Rp -	Rp -	Rp -		Rp 1.185	Rp -
Installment 3	Rp -	Rp -	Rp -		Rp 428	Rp 428
Loan Balance	Rp 7.500	Rp 13.426	Rp 14.066		Rp 428	Rp -

After the calculation of loan balance, the calculation of interest expense is conducted. In this research, the interest rate for bank loan is using the rate of 11.25%. To do this calculation, the formula below is used.

$$Interest\ Expense_t = Loan\ Balance_t\ \times i$$

Where,

i = Interest rate (%)

t = Period

Therefore, the calculation example using the formula is shown below.

$$Interest\ Expense_{2021} = Loan\ Balance_{2021}\ \times 11.25\%$$

$$Interest\ Expense_{2021} = Rp\ 13{,}426{,}000{,}000\ \times 11.25\%$$

$$Interest\ Expense_{2021} = Rp\ 1{,}510{,}475{,}808$$

The remaining interest expense for each period will be calculated using the same formula. The recapitulation of the interest expense will be shown below.

Table 6. 12 Location 4 - Interest Expense

Description	2021	2022	. . .	2027	2028
Loan Balance	Rp 13.426.451.625	Rp 15.566.652.750		Rp 2.041.370.775	Rp 428.040.225
Interest Expense	Rp 1.510.475.808	Rp 1.751.248.434		Rp 229.654.212	Rp 48.154.525

After the expenses for the project already determined, the next step is to determine the revenue stream for the project. The revenue stream for this housing development project is from the sales of the houses. In this research, the sales of all houses will be conducted gradually in each period. The detailed schedule for the sales and construction schedule will be shown in the Table 6.13.

Table 6. 13 Location 4 - Sales and Construction Schedule

Schedule		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Sales Schedule													
Type 50	100%	20%	20%	20%	20%	20%							
Type 70	100%		20%	20%	20%	20%	20%						
Type 90	100%			20%	20%	20%	20%	20%					
Type 95	100%				20%	20%	20%	20%	20%				
Type 170	100%					20%	20%	20%	20%	20%			
Type 150	100%						20%	20%	20%	20%	20%		
Construction Schedule													
Type 50	100%			20%	20%	20%	20%	20%					
Type 70	100%				20%	20%	20%	20%	20%				
Type 90	100%					20%	20%	20%	20%	20%			
Type 95	100%						20%	20%	20%	20%	20%		
Type 170	100%							20%	20%	20%	20%	20%	
Type 150	100%								20%	20%	20%	20%	20%

From the schedule above, the calculation of sales can be done by multiplying the number of houses built in the period with the selling price. Therefore, the recapitulation of the sales can be seen in the Table 6.14.

Table 6. 14 Location 4 - Sales Recapitulation

Description		2021	2022	...	2029	2030
Number of Houses						
Type 50	64	13	13			
Type 70	263		53			
Type 90	98					
Type 95	64					
Type 170	218				44	
Type 150	42				8	8
House Price						
Type 50	300.000.000	Rp 315.000.000	Rp 330.750.000		Rp 465.398.465	Rp 488.668.388
Type 70	400.000.000	Rp 420.000.000	Rp 441.000.000		Rp 620.531.286	Rp 651.557.851
Type 90	500.000.000	Rp 525.000.000	Rp 551.250.000		Rp 775.664.108	Rp 814.447.313
Type 95	600.000.000	Rp 630.000.000	Rp 661.500.000		Rp 930.796.930	Rp 977.336.776
Type 170	800.000.000	Rp 840.000.000	Rp 882.000.000		Rp 1.241.062.573	Rp 1.303.115.701
Type 150	1.000.000.000	Rp 1.050.000.000	Rp 1.102.500.000		Rp 1.551.328.216	Rp 1.628.894.627
Sales Revenue						
Type 50		Rp 4.032.000.000	Rp 4.233.600.000			
Type 70			Rp 23.196.600.000			
Type 90						
Type 95						
Type 170					Rp 54.110.328.173	

Table 6. 14 Location 4 - Sales Recapitulation

Description	2021	2022	...	2029	2030
Type 150				Rp 13.031.157.014	Rp 13.682.714.865
TOTAL REVENUE	**Rp 4.032.000.000**	**Rp 27.430.200.000**		**Rp 67.141.485.188**	**Rp 13.682.714.865**

In a property business, the business model is quite different from the other businesses. The sales in property business are conducted in the beginning of the project, while the construction of the hoses will be held later on. Because of that, the income recognition rule is implemented. The income recognition is using full accrual method which the sales is considered as revenue when the construction process of the houses is done. In this research, the construction progress is used as the basis of the income recognition calculation. The recapitulation of income recognition in this project can be seen in the Table 6.15.

Table 6. 15 Location 4 - Income Recognition (in million Rupiah)

Income Recognition	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Revenue												
Type 50	Rp 4.032	Rp 4.234	Rp 4.445	Rp 4.668	Rp 4.901							
Type 70		Rp 23.197	Rp 24.356	Rp 25.574	Rp 26.853	Rp 28.196						
Type 90			Rp 11.345	Rp 11.912	Rp 12.508	Rp 13.133	Rp 13.790					
Type 95				Rp 9.335	Rp 9.802	Rp 10.292	Rp 10.807	Rp 11.347				

Table 6. 15 Location 4 - Income Recognition (in million Rupiah)

Income Recognition	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Type 170					Rp 44.517	Rp 46.743	Rp 49.080	Rp 51.534	Rp 54.110			
Type 150						Rp 11.257	Rp 11.820	Rp 12.411	Rp 13.031	Rp 13.683		
Construction Progress												
Type 50			20,00%	20,00%	20,00%	20,00%	20,00%					
Type 70				20,00%	20,00%	20,00%	20,00%	20,00%				
Type 90					20,00%	20,00%	20,00%	20,00%	20,00%			
Type 95						20,00%	20,00%	20,00%	20,00%	20,00%		
Type 170							20,00%	20,00%	20,00%	20,00%	20,00%	
Type 150								20,00%	20,00%	20,00%	20,00%	20,00%
Income Recognition												
Type 50			Rp 4.456	Rp 4.456	Rp 4.456	Rp 4.456	Rp 4.456					
Type 70				Rp 25.635	Rp 25.635	Rp 25.635	Rp 25.635	Rp 25.635				
Type 90					Rp 12.537	Rp 12.537	Rp 12.537	Rp 12.537	Rp 12.537			
Type 95						Rp 10.316	Rp 10.316	Rp 10.316	Rp 10.316	Rp 10.316		
Type 170							Rp 49.197	Rp 49.197	Rp 49.197	Rp 49.197	Rp 49.197	
Type 150								Rp 12.440	Rp 12.440	Rp 12.440	Rp 12.440	Rp 12.440
Total Income Recognition	**-**	**-**	**Rp 4.456**	**Rp 30.091**	**Rp 42.628**	**Rp 52.945**	**Rp 102.141**	**Rp 110.126**	**Rp 84.491**	**Rp 71.953**	**Rp 61.637**	**Rp 12.440**

In a property business, there are several payment methods such as cash, mortgage, and inhouse. In this research, all the sales are using mortgage payment method. Therefore, the sales advance is also essential to be calculated in the model. The calculation of sales advance is using Ms. Excel by summing up the initial sales advance balance with the revenue and subtracted by the income recognition. The recapitulation of sales advance calculation is shown in the Table 6.16.

Table 6. 16 Location 4 - Sales Advance (in million Rupiah)

Account	2021	2022	2023	...	2030	2031	2032
Initial Balance of Sales Advances	Rp -	Rp 4.032	Rp 31.462		Rp 132.347	Rp 74.077	Rp 12.440
Sales Advances	Rp 4.032	Rp 27.430	Rp 40.146		Rp 13.683	Rp -	Rp -
Income Recognition	Rp -	Rp -	Rp 4.456		Rp 71.953	Rp 61.637	Rp 12.440
Ending Balance of Sales Advances	Rp 4.032	Rp 31.462	Rp 67.153		Rp 74.077	Rp 12.440	Rp -

Before continuing to the calculation of the financial statements, there are some adjustments to the cost regarding the income recognition. Because of the sales is recognized as income in the 2023 period, therefore the expenses that paid in 2021 and 2022 period are considered as prepaid expenses. The recognition of prepaid expense is more or less the same with the income recognition, which is based on the construction progress. Other than prepaid expenses, the interest expense is also needs to be adjusted according to the construction progress. The recapitulation of prepaid expense and interest expense calculation is shown in the Table 6.17.

Table 6. 17 Location 4 - Prepaid Expenses (in million Rupiah)

PREPAID EXPENSES	2021	2022	2023	...	2030	2031	2032
Construction Progress			3%		10%	7%	3%
Operational Expenses							
Initial Balance of Prepaid Expenses	Rp -	Rp 403	Rp 3.146		Rp 10.090	Rp 5.729	Rp 1.910

Table 6. 17 Location 4 - Prepaid Expenses (in million Rupiah)

PREPAID EXPENSES	2021	2022	2023	...	2030	2031	2032
Prepaid Expenses	Rp 403	Rp 2.743	Rp 4.015		Rp 1.368	Rp -	Rp -
G&A Expense Recognition	Rp -	Rp -	Rp 955		Rp 2.865	Rp 1.910	Rp 955
Marketing Expense Recognition	Rp -	Rp -	Rp 955		Rp 2.865	Rp 1.910	Rp 955
Ending Balance of Prepaid Expense	Rp 403	Rp 3.146	Rp 5.251		Rp 5.729	Rp 1.910	Rp -
Interest Expenses							
Initial Balance of Prepaid Expenses	Rp -	Rp 1.510	Rp 3.262		Rp 1.582	Rp 791	Rp 264
Prepaid interest expenses	Rp 1.510	Rp 1.751	Rp 1.582		Rp -	Rp -	Rp -
Interest Expenses Recognition	Rp -	Rp -	Rp 264		Rp 791	Rp 527	Rp 264
Ending Balance of Prepaid Expenses	Rp 1.510	Rp 3.262	Rp 4.580		Rp 791	Rp 264	Rp -
Total Prepaid Expenses	**Rp 1.914**	**Rp 6.408**	**Rp 9.832**		**Rp 6.520**	**Rp 2.173**	**Rp -**

Financial statements of this project will be shown in the passages below. In this chapter, the financial statements are only shown in a brief version. The detailed version of the financial statements can be seen in the attachments.

a. Income Statement

Income statement for housing project in Location 4 will be shown in the Table 6.18.

Table 6. 18 Location 4 - Income Statement (in million Rupiah)

Description	2023	2024	...	2031	2032
Revenue	**4.456**	**30.091**		**61.637**	**12.440**
Cost of Goods Sold	(1.973)	(13.532)		(26.956)	(3.995)
Gross Profit	**2.483**	**16.559**		**34.680**	**8.445**
Operating Expenses					
Marketing Expenses	(955)	(1.910)		(1.910)	(955)
General & Administrative Expenses	(955)	(1.910)		(1.910)	(955)
Total Operating Expenses	**(1.910)**	**(3.819)**		**(3.819)**	**(1.910)**
Operating Profit (EBIT)	**573**	**12.740**		**30.861**	**6.536**

Table 6. 18 Location 4 - Income Statement (in million Rupiah)

Description	2023	2024	...	2031	2032
Other Revenue & Expenses					
Interest expenses	(264)	(527)		(527)	(264)
Total Other Revenue & Expenses	**(264)**	**(527)**		**(527)**	**(264)**
Earning Before Tax (EBT)	**309**	**12.212**		**30.334**	**6.272**
Tax	(8)	(305)		(758)	(157)
Earning After Tax (EAT)	**301**	**11.907**		**29.575**	**6.115**

b. Cash Flow Statement

Cash flow statement for housing project in Location 4 will be shown in the Table 6.19.

Table 6. 19 Location 4 – Cash Flow Statement (in million rupiah)

DESCRIPTIONS	2021	2022	...	2031	2032
Operational Cash Flow					
Cash received from sales	4.032	27.430			
Cost of goods sold				(26.956)	(3.995)
Landbank Acquisition	(25.000)				
G & A Expenditure	(202)	(1.372)			
Marketing Expenditure	(202)	(1.372)			
Other income					
Other expenses					
Interest payment	(1.510)	(1.751)			
Tax payment				(758)	(157)
Total Operational Cash Flow	**(22.882)**	**22.936**		**(27.715)**	**(4.152)**
Investment Cash Flow					
Infrastructures	(3.383)	(3.383)			
Facilities	(3.587)	(3.587)			
Utilities	(164)	(164)			
Land Cut and Fill	(12.621)				
Total Investment Cash Flow	**(19.755)**	**(7.134)**			
Financing Cash Flow					
Loan Drawdown	13.426	2.140			
Loan Installment					
Owner's Funding	31.328	4.994			
Landbank Loan Installment		(1.500)			
Total Financing Cash Flow	**44.755**	**5.634**			

Table 6. 19 Location 4 – Cash Flow Statement (in million rupiah)

DESCRIPTIONS	2021	2022	...	2031	2032
Net Cash Flow	**2.118**	**21.436**		**(27.715)**	**(4.152)**
Beginning Cash Balance		**2.118**		**275.699**	**247.984**
Ending Cash Balance	**2.118**	**23.554**		**247.984**	**243.833**

c. Balance Sheet

Balance sheet for housing project in Location 4 will be shown in the Table 6.20.

Table 6. 20 Location 4 - Balance Sheet (in million rupiah)

DESCRIPTIONS	2021	2022	...	2031	2032
ASSETS					
CURRENT ASSETS					
Cash	2.118	23.554		247.984	243.833
Land Bank	25.000	25.000		20.092	20.092
Prepaid Expenses	1.914	6.408		2.173	0
TOTAL CURRENT ASSETS	**29.032**	**54.962**		**270.250**	**263.925**
FIXED ASSETS					
Existing fixed assets		19.755		26.889	26.889
New Fixed Assets	19.755	7.134			
Fixed Assets	19.755	26.889		26.889	26.889
Net Fixed Assets	19.755	26.889		26.889	26.889
TOTAL FIXED ASSETS	**19.755**	**26.889**		**26.889**	**26.889**
TOTAL ASSETS	**48.787**	**81.851**		**297.139**	**290.813**
LIABILITIES					
CURRENT LIABILITIES					
Sales Advances	4.032	31.462		12.440	(0)
TOTAL CURRENT LIABILITIES	**4.032**	**31.462**		**12.440**	**(0)**
LONG TERM LIABILITIES					
Long Term Debt	5.926	8.067			
Debt Land Acquisition	7.500	6.000			
TOTAL LONG-TERM LIABILITIES	**13.426**	**14.067**			

Table 6. 20 Location 4 - Balance Sheet (in million rupiah)

DESCRIPTIONS	2021	2022	...	2031	2032
EQUITY					
Paid-Up Capital	31.328	4.994			
Capital	31.328	36.322		36.322	36.322
Profit This Year				29.575	6.115
Retained Earnings				248.376	254.491
TOTAL EQUITY	**31.328**	**36.322**		**284.698**	**290.813**
TOTAL EQUITY & LIABILITIES	**48.787**	**81.851**		**297.139**	**290.813**

After the calculation of the financial statements is done, the result will be used to construct free cash flow calculation to do the valuation of the project using financial parameters which are NPV and IRR. The result of free cash flow projection can be seen in the Table 6.21.

Table 6. 21 Location 4 - Free Cash Flow Projection (in million rupiah)

FREE CASH FLOW	2021	2022	...	2031	2032
Operational Cash Flow					
Cash received from sales	4.032	27.430			
Cost of goods payment				(26.956)	(3.995)
Landbank Purchasing	(25.000)				
G & A Expenditure	(202)	(1.372)			
Marketing Expenditure	(202)	(1.372)			
Total Operational Cash Flow	**(21.371)**	**24.687**		**(26.956)**	**(3.995)**
Investment Cash Flow					
Infrastructures	(3.383)	(3.383)			
Facilities	(3.587)	(3.587)			
Utilities	(164)	(164)			
Land Cut and Fill	(12.621)				
Total Investment Cash Flow	**(19.755)**	**(7.134)**			
Net Free Cash Flow	**(41.126)**	**17.553**		**(26.956)**	**(3.995)**

The result of the free cash flow projection is net free cash flow that will be used to calculate the NPV and IRR. The result of the NPV and IRR calculation will be shown in the Table 6.22.

Table 6. 22 Location 4 - Valuation Result

Financial Parameters	Value
NPV	Rp 133.146.554.585
IRR	75.25%
Conclusion	**Feasible**

2. Financial Modelling and Feasibility Analysis of Location 2

Similar to the other location alternative, the first thing needed to be calculated in the financial modelling is the funding of the project. Based on the information taken from PT. X, the funding of the project will also be funded with a proportion of 30%:70% of bank loan and self-funding. The proportion for this location alternative can be seen in the Table 6.23.

Table 6. 23 Location 2 - Funding

Funding	%	Total Investment
Bank Loan	30%	Rp 65.781.690.000
Self-Funding	70%	Rp 153.490.610.000
Total		**Rp 219.272.300.000**

The total funding in the table above will be allocated into CAPEX component that already shown in the Table 6.23. In this research, the bank loan is using 2 years of grace period and tenor of 5 years. The loan drawdown will be divided into 3 periods from 2020-2022. The first period loan drawdown will be used for land acquisition. The second and third period of loan drawdown will be allocated to the investment in public facilities and social facilities. The recapitulation of loan drawdown for each period will be shown in the Table 6.24.

Table 6. 24 Location 2 - Loan Drawdown

Loan Drawdown	Tenor	Grace Period	Total Drawdown
2020 Loans	5	2	Rp 45.750.000.000
2021 Loans	5	2	Rp 14.628.885.000

Table 6. 24 Location 2 - Loan Drawdown

Loan Drawdown	Tenor	Grace Period	Total Drawdown
2022 Loans	5	2	Rp 5.402.805.000

After the calculation of the loan drawdown is done, then the loan installments are need to be calculated in this step. The calculation for loan installment during each period can be done in Ms. Excel using formula similar to the other location alternative. The calculation will be done to each drawdown in every period. The recapitulation of the calculation will be shown in the Table 6.25.

Table 6. 25 Location 2 - Debt Repayment Schedule (in million rupiah)

Debt Schedule	2020	2021	2022	...	2027	2028
Loan Initial Balance	Rp -	Rp 45.750	Rp 60.379		Rp 5.087	Rp 1.081
Loan Drawdown	Rp 45.750	Rp 14.629	Rp 5.403		Rp -	Rp -
Installment 1	Rp -	Rp -	Rp 9.150		Rp -	Rp -
Installment 2	Rp -	Rp -	Rp -		Rp 2.926	Rp -
Installment 3	Rp -	Rp -	Rp -		Rp 1.081	Rp 1.081
Loan Balance	Rp 45.750	Rp 60.379	Rp 56.632		Rp 1.081	Rp -

After the calculation of loan balance, the calculation of interest expense is conducted. In this research, the interest rate for bank loan is using the rate of 11.25%. To do this calculation, the formula used is the same with the other location alternative. The recapitulation of the interest expense will be shown below.

Table 6. 26 Location 2 - Interest Expense

Description	2021	2022	...	2027	2028
Loan Balance	Rp 60.378.885.000	Rp 65.781.690.000		Rp 5.086.899.000	Rp 1.080.561.000
Interest Expense	Rp 6.792.624.563	Rp 7.400.440.125		Rp 572.276.138	Rp 121.563.113

After the expenses for the project already determined, the next step is to determine the revenue stream for the project. The revenue stream for this housing development project is from the sales of the houses. In this research, the sales of all type of houses will be conducted gradually in each period. The detailed schedule for the sales and construction will be shown in the Table 6.27.

Table 6. 27 Sales and Construction Schedule

Schedule		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Sales Schedule											
Type 36	100%	20%	20%	20%	20%	20%					
Type 45	100%			20%	20%	20%	20%	20%			
Type 55	100%				20%	20%	20%	20%	20%		
Construction Schedule											
Type 36	100%			20%	20%	20%	20%	20%			
Type 45	100%					20%	20%	20%	20%	20%	
Type 55	100%						20%	20%	20%	20%	20%

From the schedule above, the calculation of sales can be done by multiplying the number of houses built in the period with the selling price. Therefore, the recapitulation of the sales can be seen in the Table 6.28.

Table 6. 28 Location 2 - Sales Recapitulation

Description		2021	2022	...	2027	2028
Number of Houses						
Type 36	720	144	144			
Type 45	124				25	
Type 55	96				19	19
House Price						
Type 36	420.000.000	Rp 441.000.000	Rp 463.050.000		Rp 590.982.178	Rp 620.531.286
Type 45	450.000.000	Rp 472.500.000	Rp 496.125.000		Rp 633.195.190	Rp 664.854.950
Type 55	500.000.000	Rp 525.000.000	Rp 551.250.000		Rp 703.550.211	Rp 738.727.722
Sales Revenue						
Type 36		Rp 63.504.000.000	Rp 66.679.200.000		Rp -	Rp -
Type 45		Rp -	Rp -		Rp 15.703.240.717	Rp -
Type 55		Rp -	Rp -		Rp 13.508.164.058	Rp 14.183.572.260
TOTAL REVENUE		**Rp 63.504.000.000**	**Rp 66.679.200.000**		**Rp 29.211.404.774**	**Rp 14.183.572.260**

As well as the previous location alternative, in this alternative the income recognition rule is also implemented. The income recognition is using full accrual method which the sales is considered as revenue when the construction process of the houses is done. In this

research, the construction progress is used as the basis of the income recognition calculation. The recapitulation of income recognition in this project can be seen in the Table 6.29.

Table 6. 29 Location 2 - Income Recognition (in million rupiah)

Income Recognition	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Revenue										
Type 36	Rp 63.504	Rp 66.679	Rp 70.013	Rp 73.514	Rp 77.190					
Type 45			Rp 12.919	Rp 13.565	Rp 14.243	Rp 14.955	Rp 15.703			
Type 55				Rp 11.669	Rp 12.252	Rp 12.865	Rp 13.508	Rp 14.184		
Construction Progress										
Type 36			20,00%	20,00%	20,00%	20,00%	20,00%			
Type 45					20,00%	20,00%	20,00%	20,00%	20,00%	
Type 55						20,00%	20,00%	20,00%	20,00%	20,00%
Income Recognition										
Type 36			Rp 70.180	Rp 70.180	Rp 70.180	Rp 70.180	Rp 70.180			
Type 45					Rp 14.277	Rp 14.277	Rp 14.277	Rp 14.277	Rp 14.277	
Type 55						Rp 12.896	Rp 12.896	Rp 12.896	Rp 12.896	Rp 12.896
Total Income Recognition	**Rp -**	**Rp -**	**Rp 70.180**	**Rp 70.180**	**Rp 84.457**	**Rp 97.353**	**Rp 97.353**	**Rp 27.173**	**Rp 27.173**	**Rp 12.896**

Similar to the previous location alternative, all the sales in this alternative are using mortgage payment method. Therefore, the sales advance is also essential to be calculated in the model. The calculation of sales advance is using Ms. Excel by summing up the initial sales advance balance with the revenue and subtracted by the income recognition. The recapitulation of sales advance calculation is shown in the Table 6.30.

Table 6. 30 Location 2 - Sales Advances (in million rupiah)

Account	2021	2022	2023	...	2028	2029	2030
Initial Balance of Sales Advances	Rp -	Rp 63.504	Rp 130.183		Rp 53.058	Rp 40.068	Rp 12.896
Sales Advances	Rp 63.504	Rp 66.679	Rp 82.932		Rp 14.184	Rp -	Rp -
Income Recognition	Rp -	Rp -	Rp 70.180		Rp 27.173	Rp 27.173	Rp 12.896
Ending Balance of Sales Advances	Rp 63.504	Rp 130.183	Rp 142.936		Rp 40.068	Rp 12.896	Rp -

Before continuing to the calculation of the financial statements, there are some adjustments to the cost regarding the income recognition. Because of the sales is recognized as income in the 2023 period, therefore the expenses that paid in 2021 and 2022 period are considered as prepaid expenses. The recognition of prepaid expense is more or less the same with the income recognition, which is based on the construction progress. Other than prepaid expenses, the interest expense is also needs to be adjusted according to the construction progress. The recapitulation of prepaid expense and interest expense calculation is shown in the Table 6.31.

Table 6. 31 Location 2 - Prepaid Expenses (in million rupiah)

PREPAID EXPENSES	2021	2022	2023	...	2028	2029	2030
Construction Progress			3%		10%	7%	3%
Operational Expenses							
Initial Balance of	Rp -	Rp 6.350	Rp 13.018		Rp 14.807	Rp 9.735	Rp 3.245

Table 6. 31 Location 2 - Prepaid Expenses (in million rupiah)

PREPAID EXPENSES	2021	2022	2023	...	2028	2029	2030
Prepaid Expenses							
Prepaid Expenses	Rp 6.350	Rp 6.668	Rp 8.293		Rp 1.418	Rp -	Rp -
G&A Expense Recognition	Rp -	Rp -	Rp 1.623		Rp 3.245	Rp 3.245	Rp 1.623
Marketing Expense Recognition	Rp -	Rp -	Rp 1.623		Rp 3.245	Rp 3.245	Rp 1.623
Ending Balance of Prepaid Expense	Rp 6.350	Rp 13.018	Rp 18.066		Rp 9.735	Rp 3.245	Rp -
Interest Expenses							
Initial Balance of Prepaid Expenses	Rp -	Rp 6.793	Rp 14.193		Rp 10.497	Rp 6.371	Rp 2.124
Prepaid interest expenses	Rp 6.793	Rp 7.400	Rp 6.371		Rp 122	Rp -	Rp -
Interest Expenses Recognition	Rp -	Rp -	Rp 2.124		Rp 4.247	Rp 4.247	Rp 2.124
Ending Balance of Prepaid Expenses	Rp 6.793	Rp 14.193	Rp 18.440		Rp 6.371	Rp 2.124	Rp -
Total Prepaid Expenses	**Rp 13.143**	**Rp 27.211**	**Rp 36.507**		**Rp 16.106**	**Rp 5.369**	**Rp -**

Financial statements of this project will be shown in the passages below. In this chapter, the financial statements are only shown in a brief version. The detailed version of the financial statements can be seen in the attachments.

a. Income Statement

Income statement for housing project in Location 2 will be shown in the Table 6.32.

Table 6. 32 Location 2 - Income Statement (in million rupiah)

Description	2023	2024	...	2029	2030
Revenue	**70.180**	**70.180**		**27.173**	**12.896**
Cost of Goods Sold	(17.786)	(18.134)		(8.341)	(4.115)

Table 6. 32 Location 2 - Income Statement (in million rupiah)

Description	2023	2024	...	2029	2030
Gross Profit	**52.394**	**52.046**		**18.831**	**8.780**
Operating Expenses					
Marketing Expenses	(1.623)	(1.623)		(3.245)	(1.623)
General & Administrative Expenses	(1.623)	(1.623)		(3.245)	(1.623)
Total Operating Expenses	**(3.245)**	**(3.245)**		**(6.490)**	**(3.245)**
Operating Profit (EBIT)	**49.148**	**48.801**		**12.341**	**5.535**
Other Revenue & Expenses					
Interest expenses	(2.124)	(2.124)		(4.247)	(2.124)
Total Other Revenue & Expenses	**(2.124)**	**(2.124)**		**(4.247)**	**(2.124)**
Earning Before Tax (EBT)	**47.025**	**46.677**		**8.094**	**3.412**
Tax	(1.176)	(1.167)		(202)	(85)
Earning After Tax (EAT)	**45.849**	**45.510**		**7.891**	**3.326**

b. Cash Flow Statement

Cash flow statement for housing project in Location 2 will be shown in the Table 6.33.

Table 6. 33 Location 2 - Cash Flow Statement

DESCRIPTIONS	2021	2022	...	2029	2030
Operational Cash Flow					
Cash received from sales	63.504	66.679			
Cost of goods sold				(7.279)	(3.611)
Landbank Acquisition	(152.500)				
G & A Expenditure	(3.175)	(3.334)			
Marketing Expenditure	(3.175)	(3.334)			
Other income					
Other expenses					
Interest payment	(6.793)	(7.400)			
Tax payment				(202)	(85)
Total Operational Cash Flow	**(102.139)**	**52.611**		**(7.482)**	**(3.697)**
Investment Cash Flow					
Infrastructures	(7.554)	(7.554)			
Facilities	(10.119)	(10.119)			
Utilities	(336)	(336)			
Land Cut and Fill	(30.754)				
Total Investment Cash Flow	**(48.763)**	**(18.009)**			
Financing Cash Flow					

Table 6. 33 Location 2 - Cash Flow Statement

DESCRIPTIONS	2021	2022	...	2029	2030
Loan Drawdown	60.379	5.403			
Loan Installment					
Owner's Funding	140.884	12.607			
Landbank Loan Installment		(9.150)			
Total Financing Cash Flow	**201.263**	**8.859**			
Net Cash Flow	**50.361**	**43.461**		**(7.482)**	**(3.697)**
Beginning Cash Balance		**50.361**		**230.081**	**222.600**
Ending Cash Balance	**50.361**	**93.822**		**222.600**	**218.903**

c. Balance Sheet

Balance sheet for housing project in Location 2 will be shown in the Table 6.34.

Table 6. 34 Location 2 - Balance Sheet (in million rupiah)

DESCRIPTIONS	2021	2022	...	2029	2030
ASSETS					
CURRENT ASSETS					
Cash	50.361	93.822		222.600	218.903
Land Bank	152.500	152.500		134.734	134.230
Prepaid Expenses	13.143	27.211		5.369	
TOTAL CURRENT ASSETS	**216.004**	**273.533**		**362.702**	**353.133**
FIXED ASSETS					
Existing fixed assets		48.763		66.772	66.772
New Fixed Assets	48.763	18.009			
Fixed Assets	48.763	66.772		66.772	66.772
Net Fixed Assets	48.763	66.772		66.772	66.772
TOTAL FIXED ASSETS	**48.763**	**66.772**		**66.772**	**66.772**
TOTAL ASSETS	**264.767**	**340.306**		**429.475**	**419.905**
LIABILITIES					
CURRENT LIABILITIES					
Sales Advances	63.504	130.183		12.896	
TOTAL CURRENT LIABILITIES	**63.504**	**130.183**		**12.896**	

Table 6. 34 Location 2 - Balance Sheet (in million rupiah)

DESCRIPTIONS	2021	2022	...	2029	2030
LONG TERM LIABILITIES					
Long Term Debt	14.629	20.032			
Debt Land Acquisition	45.750	36.600			
TOTAL LONG-TERM LIABILITIES	**60.379**	**56.632**			
EQUITY					
Paid-Up Capital	140.884	12.607			
Capital	140.884	153.491		153.491	153.491
Profit This Year				7.891	3.326
Retained Earnings				263.089	266.415
TOTAL EQUITY	**140.884**	**153.491**		**416.579**	**419.905**
TOTAL EQUITY & LIABILITIES	**48.787**	**81.851**		**297.139**	**290.813**

After the calculation of the financial statements is done, the result will be used to construct free cash flow calculation to do the valuation of the project using financial parameters which are NPV and IRR. The result of free cash flow projection can be seen in the Table 6.35.

Table 6. 35 Location 2 - Free Cash Flow (in million rupiah)

FREE CASH FLOW	2021	2022	...	2029	2030
Operational Cash Flow					
Cash received from sales	63.504	66.679			
Cost of goods payment				(7.279)	(3.611)
Landbank Purchasing	(152.500)				
G & A Expenditure	(3.175)	(3.334)			
Marketing Expenditure	(3.175)	(3.334)			
Total Operational Cash Flow	**(95.346)**	**60.011**		**(7.279)**	**(3.611)**
Investment Cash Flow					
Infrastructures	(7.554)	(7.554)			
Facilities	(10.119)	(10.119)			
Utilities	(336)	(336)			

Table 6. 35 Location 2 - Free Cash Flow (in million rupiah)

FREE CASH FLOW	2021	2022	...	2029	2030
Land Cut and Fill	(30.754)				
Total Investment Cash Flow	**(48.763)**	**(18.009)**			
FREE CASH FLOW	**(144.109)**	**42.002**		**(7.279)**	**(3.611)**

The result of the free cash flow projection is net free cash flow that will be used to calculate the NPV and IRR. The result of the NPV and IRR calculation will be shown in the Table 6.36.

Table 6. 36 Location 2 - Valuation Result

Financial Parameters	Value
NPV	Rp 40.004.766.068
IRR	23.66%
Conclusion	**Feasible**

6.2.3 Sensitivity Analysis

This subchapter will consist of the information about the process and result of sensitivity analysis done to the location alternatives, which are location 4 and location 2. The sensitivity analysis will be done in order to know which independent variable that give significant impact to the overall conclusion of the model. In this research, the sensitivity analysis is done using Ms. Excel software data analysis function. In the sensitivity analysis for both alternatives, the independent variables used are land price and construction cost as those values has the most impact to the financial model result. The detail of the process will be shown in the passages below.

a. Sensitivity Analysis – Location 4

In calculating the sensitivity analysis of the land price, the difference of each level is using Rp 25.000,00. While for calculating the sensitivity analysis of the construction cost, the difference used on each level is Rp 250.000. The amount of difference for each level is determined in order to know the feasibility threshold of each parameter.

The difference gained in this sensitivity analysis will resulted to a different NPV and IRR for the location alternative. The recapitulation of sensitivity process result can be seen in the Table 6.37 and 6.38.

Table 6. 37 Location 4 - Land Price Sensitivity Result

Location 4 - Land Price					
Land Price		NPV		IRR	Conclusion
Rp	25.000	Rp	151.893.162.584	123,05%	Feasible
Rp	50.000	Rp	145.644.293.251	101,18%	Feasible
Rp	75.000	Rp	139.395.423.918	86,25%	Feasible
Rp	100.000	Rp	133.146.554.585	75,25%	Feasible
Rp	125.000	Rp	126.897.685.252	66,69%	Feasible
Rp	150.000	Rp	120.648.815.919	59,79%	Feasible
Rp	175.000	Rp	114.399.946.586	54,05%	Feasible
Rp	200.000	Rp	108.151.077.253	49,19%	Feasible
Rp	225.000	Rp	101.902.207.921	44,99%	Feasible
Rp	250.000	Rp	95.652.695.344	41,30%	Feasible
Rp	275.000	Rp	89.402.695.344	38,04%	Feasible
Rp	300.000	Rp	83.152.695.344	35,11%	Feasible
Rp	325.000	Rp	76.902.695.344	32,47%	Feasible
Rp	350.000	Rp	70.652.695.344	30,06%	Feasible
Rp	375.000	Rp	64.402.695.344	27,85%	Feasible
Rp	400.000	Rp	58.152.695.344	25,82%	Feasible
Rp	425.000	Rp	51.902.695.344	23,94%	Feasible
Rp	450.000	Rp	45.652.695.344	22,19%	Feasible
Rp	475.000	Rp	39.402.695.344	20,55%	Feasible
Rp	500.000	Rp	33.152.695.344	19,02%	Feasible
Rp	525.000	Rp	26.902.695.344	17,57%	Feasible
Rp	550.000	Rp	20.652.695.344	16,21%	Feasible
Rp	575.000	Rp	14.402.695.344	14,92%	Feasible
Rp	600.000	Rp	8.152.695.344	13,70%	Feasible
Rp	625.000	Rp	1.902.695.344	12,53%	Feasible
Rp	650.000	-Rp	4.347.304.656	11,42%	Not Feasible
Rp	675.000	-Rp	10.597.304.656	10,36%	Not Feasible
Rp	700.000	-Rp	16.847.304.656	9,35%	Not Feasible

Initial Condition

Table 6. 38 Location 4 - Construction Cost Sensitivity Result

Location 4 - Construction Cost					
Escalation Rate		**NPV**		**IRR**	**Conclusion**
Rp	-	Rp	240.417.042.460	86,79%	Feasible
Rp	250.000	Rp	229.689.993.672	85,77%	Feasible
Rp	500.000	Rp	218.962.944.885	84,73%	Feasible
Rp	750.000	Rp	208.235.896.097	83,66%	Feasible
Rp	1.000.000	Rp	197.508.847.310	82,56%	Feasible
Rp	1.250.000	Rp	186.781.798.522	81,44%	Feasible
Rp	1.500.000	Rp	176.054.749.735	80,28%	Feasible
Rp	1.750.000	Rp	165.327.700.947	79,08%	Feasible
Rp	2.000.000	Rp	154.600.652.160	77,85%	Feasible
Rp	2.250.000	Rp	143.873.603.373	76,57%	Feasible
Rp	2.500.000	Rp	133.146.554.585	75,25%	Feasible
Rp	2.750.000	Rp	122.419.505.798	73,87%	Feasible
Rp	3.000.000	Rp	111.691.852.766	72,44%	Feasible
Rp	3.250.000	Rp	100.961.431.476	70,94%	Feasible
Rp	3.500.000	Rp	90.231.010.187	69,36%	Feasible
Rp	3.750.000	Rp	79.500.588.897	67,70%	Feasible
Rp	4.000.000	Rp	68.770.167.608	65,94%	Feasible
Rp	4.250.000	Rp	58.039.746.319	64,07%	Feasible
Rp	4.500.000	Rp	47.309.325.029	62,11%	Feasible
Rp	4.750.000	Rp	36.578.903.740	60,67%	Feasible
Rp	5.000.000	Rp	25.848.482.450	58,46%	Feasible

Initial Condition

b. Sensitivity Analysis – Location 2

Similar to the process before, in calculating the sensitivity analysis of the land price, the difference of each level is using Rp 25.000,00. While for calculating the sensitivity analysis of the construction cost, the difference used on each level is Rp 250.000. The amount of difference for each level is determined in order to know the feasibility threshold of each parameter.

The difference gained in this sensitivity analysis will resulted to a different NPV and IRR for the location alternative. The recapitulation of sensitivity process result can be seen in the Table 6.39 and 6.40.

Table 6. 39 Location 2 - Land Price Sensitivity Result

Location 2 - Land Price					
Land Price		NPV		IRR	Conclusion
Rp	25.000	Rp	177.254.766.068	649,55%	Feasible
Rp	50.000	Rp	162.004.766.068	217,92%	Feasible
Rp	75.000	Rp	146.754.766.068	132,92%	Feasible
Rp	100.000	Rp	131.504.766.068	94,44%	Feasible
Rp	125.000	Rp	116.254.766.068	71,71%	Feasible
Rp	150.000	Rp	101.004.766.068	56,36%	Feasible
Rp	175.000	Rp	85.754.766.068	45,12%	Feasible
Rp	200.000	Rp	70.504.766.068	36,43%	Feasible
Rp	225.000	Rp	55.254.766.068	29,44%	Feasible
Rp	250.000	Rp	40.004.766.068	23,66%	Feasible
Rp	275.000	Rp	24.754.766.068	18,77%	Feasible
Rp	300.000	Rp	9.504.766.068	14,55%	Feasible
Rp	325.000	-Rp	5.745.233.932	10,85%	Not Feasible
Rp	350.000	-Rp	20.995.233.932	7,58%	Not Feasible
Rp	375.000	-Rp	36.245.233.932	4,65%	Not Feasible
Rp	400.000	-Rp	51.495.233.932	2,01%	Not Feasible
Rp	425.000	-Rp	66.745.233.932	-0,40%	Not Feasible
Rp	450.000	-Rp	81.995.233.932	-2,61%	Not Feasible
Rp	475.000	-Rp	97.245.233.932	-4,65%	Not Feasible
Rp	500.000	-Rp	112.495.233.932	-6,55%	Not Feasible

Initial Condition

Table 6. 40 Location 2 - Construction Cost Sensitivity Result

Location 2 - Construction Cost					
Escalation Rate		NPV		IRR	Conclusion
Rp	-	Rp	100.661.414.356	35,19%	Feasible
Rp	250.000	Rp	94.595.749.527	34,20%	Feasible
Rp	500.000	Rp	88.530.084.698	33,17%	Feasible
Rp	750.000	Rp	82.464.419.870	32,12%	Feasible
Rp	1.000.000	Rp	76.398.755.041	31,03%	Feasible
Rp	1.250.000	Rp	70.333.090.212	29,92%	Feasible
Rp	1.500.000	Rp	64.267.425.383	28,76%	Feasible
Rp	1.750.000	Rp	58.201.760.554	27,56%	Feasible
Rp	2.000.000	Rp	52.136.095.726	26,32%	Feasible
Rp	2.250.000	Rp	46.070.430.897	25,02%	Feasible
Rp	2.500.000	Rp	40.004.766.068	23,66%	Feasible

Table 6. 40 Location 2 - Construction Cost Sensitivity Result

Location 2 - Construction Cost					
Escalation Rate		NPV		IRR	Conclusion
Rp	2.750.000	Rp	33.939.101.239	22,24%	Feasible
Rp	3.000.000	Rp	27.873.436.410	20,73%	Feasible
Rp	3.250.000	Rp	21.807.771.581	19,13%	Feasible
Rp	3.500.000	Rp	15.742.106.753	17,41%	Feasible
Rp	3.750.000	Rp	9.676.441.924	15,56%	Feasible
Rp	4.000.000	Rp	3.610.777.095	13,52%	Feasible
Rp	4.250.000	-Rp	2.454.887.734	11,23%	Not Feasible
Rp	4.500.000	-Rp	8.520.552.563	8,57%	Not Feasible
Rp	4.750.000	-Rp	14.586.217.391	5,31%	Not Feasible
Rp	5.000.000	-Rp	20.651.882.220	0,64%	Not Feasible

Initial Condition

6.3 Analysis and Interpretation

This subchapter will consist of the information about the analysis and interpretation in this research. The analysis and interpretation were made based on the objectives of the research considering results from data processing phase. It will include the analysis of feasibility result and sensitivity analysis of feasibility result.

6.3.1 Analysis of Feasibility Result

In this research, there are two location alternatives to be assessed which are Location 4 and Location 2. The location 4 has an area of 250.000 m^2 with six types of houses offered, namely Type 50, Type 70, Type 90, Type 95, Type 170, and Type 150. While location 2 has an area of 610.000 m^2 with three types of houses offered, namely Type 36, Type 45, and Type 55. To calculate the free cash flow for this type of business, which is property business, there are slight differences with the other type of business. The first difference is in the planning horizon, in this type of business there are no limit in the planning horizon since even after the construction ends, the project will be still in PT. X possession. While for the calculation of financial valuation parameters, the planning horizon is considered until the construction process is done. The second difference is since there are no limit in the planning horizon, there is no need to calculate the terminal value of the

project. While for the free cash flow is calculated from the start of the project to the end of construction process. The last difference is there is no need to calculate the net working capital, since the sales of the houses starts in the beginning of the horizon and the construction starts two years after the sales. In the feasibility analysis, there are two financial valuation parameters to be used, which are NPV and IRR. Those parameters will be used in order to determine the feasibility of each location alternative.

Location 4 has an area of 250.000 m^2 with the land price of Rp 100.000. This location alternative has six types of houses that will be built with the total of 749 houses to be built. The CAPEX needed to fund this project has a total of Rp 51.888.842.500 consists of land acquisition and the construction of public facilities. The only revenue stream of this project comes from the sales of the houses. The sales starts from the beginning of the project which is 2021 and projected to end in 2030. While the cost incurred in this project is from the construction process which will start two years after the sales of the house, starts in 2023 and projected to end in 2032. Therefore, the annual cash flow only has income up to 2030 when all the sales is already done, while for 2031 and 2032 the annual cash flows are definitely negative because there is no revenue stream in those periods. From the free cash flow, it is calculated that the NPV of Location 4 alternative is equal to Rp 133.146.554.585 with IRR value of 75,25%. From the result of financial valuation parameters for Location 4 alternative, it can be concluded that the project is feasible since the NPV is positive and the IRR is greater than the WACC rate. The value of the financial valuation parameters for this alternative is considered very high, that can happen because PT.X has a subsidiary in construction sector; hence the construction cost of the housing development is relatively low from the standard rate in Sidoarjo. Other than the construction cost, the land price of Location 4 is also inexpensive compared to the other lands in Tanggulangin Subdistrict which can reach Rp 2.000.000 for the price.

Location 2 has an area of 610.000 m^2 with the land price of Rp 250.000. This location alternative has three types of houses that will be built with a total of 940 houses to be built. The CAPEX needed to fund this project is Rp 219.272.300.000 consists of land acquisition and the construction of public

facilities. Similar to the Location 4, for the Location 2 also has one revenue stream which comes from the sales of the houses. The sales for this alternative start from 2021 and projected to end in 2028, two years short from the Location 4 because in Location 2, there are only three types of houses. The cost incurred is also similar, from the construction cost which starts in 2023 and projected to end in 2030. Therefore, the annual cash flow also has income up to 2028 when all the sales is already done, while for 2029 and 2030 the annual cash flows are definitely negative because there is no revenue stream in those periods. From the free cash flow projected, it is calculated that the NPV of Location 2 alternative is equal to Rp 40.004.766.068 and IRR value of 23,66%. From the result of financial valuation parameters for Location 2 alternative, it can be concluded that the project is feasible since the NPV is positive and the IRR is greater than the WACC rate. The value of financial valuation parameters for this alternative is not as high as the Location 4, because the land area needed for this project is high with an area of 61 hectares which affect to raise the investment cost in this alternative. Ideally, the more land available, the more house can be built and the sales become higher. In this case, the Location 2 has wider land available with 61 hectares, but the number of houses built is not really meet the available land. In other word, the land efficiency is lower from the Location 4. It can happen because the Location 2 in stages and this research is the first stage projection of the construction process.

From the two location alternatives, both of the alternatives are resulted to a feasible conclusion to be implemented from the financial perspective. Moreover, there is a need to identify the key parameter that affect the result of financial model. Therefore, the assessment is done using sensitivity analysis approach.

6.3.2 Sensitivity Analysis of Feasibility Result

Sensitivity analysis is done to test the volatility of independent variables included in the financial model and feasibility analysis calculation. Volatility is used to know how reactive the financial valuation parameters will change if a certain independent variable in the financial model and feasibility analysis change. In this research, the independent variables that will be tested for both location alternative is the same, which are land price and construction cost. Those

independent variables are used as the costs are volatile. Land price will easily change to become more expensive with the construction of facilities around the land location, such as the construction of educational facilities, health facilities, and toll road projects. While the construction cost is easier to change depends on the inflation level and the macroeconomic situation within the region or the country. The decision-making indicators included in the analysis is the financial valuation parameters which are NPV and IRR.

As mentioned above, Location 4 alternative used land price and construction cost as its sensitivity analysis parameter. The result of analysis shows that the increase of cost is slowly decrease the location alternative NPV and IRR. At the initial condition, with the land price of Rp 100.000 and construction cost of Rp 2.500.000, this location alternative has an NPV value equal to Rp 133.146.554.585 with IRR value of 75,25%. When the land price is increased to Rp 700.000 or escalated by 600%, the NPV falls into (Rp 16.847.304.656) as well as the IRR value with 9,35%. While if the construction cost is increased to Rp 5.000.000 or escalated by 100%, the NPV falls into Rp 25.848.482.450 and the IRR value of 58,46%. From the result it can be seen that the Location 4 alternatives becomes not feasible in the threshold of Rp 650.000 land price or escalated by 550%. While for the construction cost, even after escalated by 100%, the feasibility result is still concluded feasible.

As for the Location 2 alternative, it is also used land price and construction cost as its sensitivity analysis parameter. The result of analysis shows that the increase of costs is slowly decrease the location alternative NPV and IRR. At the initial condition, with the land price or Rp 250.000 and construction cost of Rp 2.500.000, this location has an NPV equal to Rp 40.004.766.068 and IRR value of 23,66%. When the land price is increased to Rp 500.000 or escalated by 100%, the value of NPV falls onto (Rp 112.495.233.932) with the IRR value of -6,55%. While if the construction cost is increased to Rp 5.000.000 or escalated by 100%, the NPV falls into (Rp 20.651.882.220) with IRR value of 0,64%. From the sensitivity result, it can be seen that the Location 2 alternatives becomes not feasible in the threshold of Rp 325.000 land price or an escalation of 30%. While for the construction cost the threshold lies on Rp 4.250.000 or an escalation of 70%.

From the result of both location alternatives sensitivity analysis, it can be concluded that land price has the most significant impact to the overall financial model and feasibility analysis since the land acquisition activity in the beginning of the project is driven by the land price.

CHAPTER 7
CONCLUSIONS AND SUGGESTIONS

This chapter will consist of information about conclusions that can be drawn by the author from this research according to the research objectives which already has been stated before and suggestions from the authors for improvement on further research development.

7.1 Conclusions

The conclusions that can be made from this research are:

1. Through the demand forecast process using linear trend, exponential trend, quadratic trend, and s-curve method, the smallest value of MAPE and MAD is quadratic trend method. The potential demand is the number of households that do not have their own residential building, which are 15,8% from the forecasted result of demand. With a stagnant supply projection of 4.018 housing units built per year, it can be calculated that the unmet demand of houses are 107.749 units in 2021, 108.013 units in 2022, 107.932 units in 2023, 107.507 units in 2024, and 106.738 units in 2025. Since the unmet demand of house in Sidoarjo District is still wide, it can be concluded that if PT. X will carry out a housing development project in the meantime, the project will be feasible from the market perspective.
2. In the process of priority location determination, there are six criteria that used as the main consideration which are distance to main road, land slope, distance to electric grid, distance to health facility, distance to education facility, and spatial pattern of Sidoarjo District. The most influential criteria are spatial pattern of Sidoarjo District with 43% of influence, it is because the local regulation of Sidoarjo District states that all housing development projects can only be built in the settlement area based on the spatial pattern. With using Weighted Overlay method in spatial analyst feature from ArcGIS, it is obtained the priority area which

divides into five area which are Priority I, Priority II, Priority III, Priority IV, and Priority V with Priority I has the highest value. Priority V has the biggest area with 432,73 km^2, because based on the spatial pattern of Sidoarjo District, the majority of the area is devoted to certain interests or indeed there are natural objects that should be preserved and not suitable for settlement. From the result of the weighted overlay tools, it can be seen that there is one location in Priority I which is location 4, one location in Priority II which is location 2, one location in Priority III which is location 1, and one location in Priority V which is location 3.

3. Feasibility analysis of each location alternatives results shows that Location 4 alternative has NPV amount equal to Rp 133.146.554.585 with IRR value of 75,25%; Location 2 alternative has NPV amount equal to Rp 40.004.766.068 and IRR value of 23,66%. Therefore, both location alternatives are considered feasible to be implemented by PT. X.
4. Sensitivity analysis results for Location 4 alternative has a threshold of Rp 650.000 land price or an escalation of 550%, while for the construction cost, even after escalated by 100%, the feasibility result is still concluded feasible. Meanwhile, the Location 2 alternative has a threshold of Rp 325.000 land price or an escalation of 30%, while for the construction cost the threshold lies on Rp 4.250.000 or an escalation of 70%. From the result of both location alternatives sensitivity analysis, it can be concluded that land price has the most significant impact to the overall impact of the financial model and feasibility analysis since the land acquisition activity in the beginning of the project is driven by the land price.

7.2 Suggestions

The suggestions taken that should be done for further development from this research are:

1. There is a need of more detailed study of risk management and mitigation about the property development before it is implemented.

2. Sidoarjo District Government should provide the shape file of disaster map in Sidoarjo District in order to conduct better weighted overlay result.
3. There is a need of more detailed study of housing supply projection since in this research the supply determination is not time-related.
4. There is a need of more detailed study of land efficiency in a housing development project.

(This page is intentionally left blank)

REFERENCES

Badan Standarisasi Nasional, 2004. *SNI 03-1733-2004 Tata cara perencanaan lingkungan perumahan di perkotaan.* Jakarta: Badan Standarisasi Nasional.

Dempsey, C., 2019. *What is GIS?.* [Online] Available at: https://www.gislounge.com/what-is-gis/ [Accessed 6 May 2021].

ESRI, 2017. *What is GIS?.* [Online] Available at: esri.com/en-us/what-is-gis/overview [Accessed 6 May 2021].

ESRI, 2020. *What is the Spatial Analyst extension?.* [Online] Available at: https://desktop.arcgis.com/en/arcmap/latest/extensions/spatial-analyst/what-is-the-spatial-analyst-extension.htm [Accessed 6 May 2021].

Fernando, J., 2021. *Amortization.* [Online] Available at: https://www.investopedia.com/terms/a/amortization.asp [Accessed 27 May 2021].

Fernando, J., 2021. *Discounted Cash Flow (DCF).* [Online] Available at: https://www.investopedia.com/terms/d/dcf.asp [Accessed 27 May 2021].

Fernando, J., 2021. *Inflation.* [Online] Available at: https://www.investopedia.com/terms/i/inflation.asp [Accessed 28 May 2021].

Fernando, J., 2021. *Internal Rate of Return (IRR).* [Online] Available at: https://www.investopedia.com/terms/i/irr.asp [Accessed 28 May 2021].

Fernando, J., 2021. *Net Present Value (NPV).* [Online] Available at: https://www.investopedia.com/terms/n/npv.asp [Accessed 28 May 2021].

Frick, H. & Mulyani, T. H., 2006. *Arsitektur Ekologis.* Yogyakarta: Kanisius.

Government of Indonesia, 1992. *Undang-Undang Nomor 4 Tahun 1992 Tentang Perumahan dan Permukiman.* Jakarta: Lembaran Negara Republik Indonesia.

Government of Indonesia, 2011. *Undang-Undang No. 1 Tahun 2011 Tentang Perumahan dan Wilayah Permukiman.* Jakarta: Lembaran Negara Republik Indonesia.

Gunarta, I. K., 2020. *FInance for Engineer.* Surabaya: ITS Tekno Sais.

Gunarta, I. K., 2020. *Penilaian Usaha.* Surabaya: ITS Tekno Sains.

Gunarta, I. K., Eriyanto, E. & Miftah, A., 2012. Modelanalisis Geo-Spasial Penentuan Jalur Transportasi Industri Crude Palm Oil Menggunakan Algoritma DJIKSTRA. *Industrial and Systems Engineering Assessment Journal (INASEA),* 13(1).

Gunarta, I. K., Eriyanto, Fauzi, A. M. & Kusumuljono, B. S., 2013. Pengembangan Industri Crude Palm Oil Berkelanjutan dengan Menggunakan Model Geo-Spatial Multicriteria Decision Analysis. *Bumi Lestari Journal of Environment,* pp. 16-26.

Gunarta, I. K. & Ramadhani, A., 2014. *Pemilihan Alternatif Lokasi Onshore/Offshore Coal Transhipment dengan Menggunakan Model Analisis Spasial.* Surabaya: Institut Teknologi Sepuluh Nopember.

Hargrave, M., 2021. *Weighted Average Cost of Capital (WACC).* [Online] Available at: https://www.investopedia.com/terms/w/wacc.asp [Accessed 27 May 2021].

Hayes, A., 2021. *Cost of Capital.* [Online] Available at: https://www.investopedia.com/terms/c/costofcapital.asp [Accessed 27 May 2021].

Heizer, J. & Render, B., 2011. *Operations Management.* 10th ed. New Jersey: Prentice Hall.

Hyndman, R. J. & Athanasopoulos, G., 2018. *Forecasting: Principles and Practice.* 2nd ed. Melbourne: OTexts.

Ishizaka, A. & Labib, A., 2009. Analytic Hierarchy Process and Expert Choice: Benefits and Limitations. *OR Insight,* 22(4), pp. 201-220.

Kagan, J., 2021. *Payback Period.* [Online] Available at: https://www.investopedia.com/terms/p/paybackperiod.asp [Accessed 28 May 2021].

Kenton, W., 2020. *Sensitivity Analysis.* [Online] Available at: https://www.investopedia.com/terms/s/sensitivityanalysis.asp [Accessed 24 May 2021].

Kenton, W., 2021. *Cost of Equity.* [Online] Available at: https://www.investopedia.com/terms/c/costofequity.asp [Accessed 27 May 2021].

Kopp, C. M., 2020. *Financial Modeling.* [Online] Available at: https://www.investopedia.com/terms/f/financialmodeling.asp [Accessed 27 May 2021].

Kotler, P. & Keller, K. L., 2009. *Manajemen Pemasaran.* 13th ed. Jakarta: Erlangga.

Maretta, N., Dewi, C., Murdapa, F. & Rahmadi, E., 2019. Kajian Lokasi Potensial Perumahan dan Permukiman di Kabupaten Pesawaran dengan Sistem Informasi Geografis. *Jurnal Geofisika Eksplorasi,* 5(3), pp. 26-33.

Mayhew, S., 2004. *A Dictionary of Geography.* Oxford: Oxford University Press.

Minister for Public Works and Human Settlements, 2005. *Pd T-03-2005-C Tata Cara Pemilihan Lokasi Prioritas untuk Pengembangan Perumahan dan Permukiman di Kawasan Perkotaan.* Jakarta: Pusat Penelitian dan Pengembangan Permukiman.

Ministry of Home Affairs, 1974. *Permendagri No. 5 tahun 1974 Tentang Ketentuan-ketentuan Mengenai Penyediaan dan Pemberian Tanah untuk Keperluan Perusahaan.* Jakarta: Pusat Hukum dan Humas BPN RI.

Murphy, C. B., 2021. *What is The Formula for Calculating Free Cash Flow.* [Online]
Available at: https://www.investopedia.com/ask/answers/033015/what-formula-calculating-free-cash-flow.asp
[Accessed 27 May 2021].

National Geographic, 2017. *GIS (Geographic Information System).* [Online] Available at: https://www.nationalgeographic.org/encyclopedia/geographic-information-system-gis/#:~:text=GIS-,A%20geographic%20information%20system%20(GIS)%20is%20a%20computer%20system%20for,streets%2C%20buildings%2C%20and%20vegeta

tion.
[Accessed 6 May 2021].

Project Management Institute, 2013. *PMBOK Guide.* 5th ed. Pennsylvania: Project Management Institute.

Purnomo, R. S. D., Serfiyani, C. Y. & Hariyani, I., 2011. *Kitab Hukum Bisnis Properti.* Yogyakarta: Pustaka Yustisia.

Saaty, T. L., 1977. A Scaling Method for Priorities in Hierarchical Structures. *Journal of Mathematical Psychology,* 15(3), pp. 234-281.

Saputra, D. P. D., Rachmawati, R. & Mei, E. T. W., 2016. Penentuan Prioritas Lokasi Perumahan di Kecamatan Kasihan dengan Menggunakan Sistem Informasi Geografis. *Jurnal Bumi Indonesia,* 5(1).

Sastra, S. & Marlina, E., 2006. *Perencanaan dan Pengembangan Perumahan.* Yogyakarta: Andi.

Tjia, J. S., 2009. *Building Financial Models: The Complete Guide to Designing, Building, and Applying Projection Models.* 2nd ed. New York: McGraw-Hill.

Tuovila, A., 2021. *Depreciation.* [Online] Available at: https://www.investopedia.com/terms/d/depreciation.asp [Accessed 27 May 2021].

Umar, H., 2005. *Riset Pemasaran & Perilaku Konsumen.* 2 ed. Jakarta: Gramedia Pustaka Utama.

Yusminar, 2002. *Analisis Pasar Perumahan Kota Semarang,* Semarang: Universitas Diponegoro.

Zuhriyah, F., Yahdi, M. & DP, R. W., 2019. Analisis Penerapan Akuntansi Pengakuan Pendapatan Pada Perusahaan Properti “PT. Rojoland Indonesia Build”. *Jurnal Riset Akuntansi,* 1(4), pp. 17-26.

LIST OF ATTACHMENTS

Attachment 1 Location 4 Detailed Financial Modelling 153
Attachment 2 Location 2 Detailed Financial Modelling 165

Attachment 1 Location 4 Detailed Financial Modelling

Location 4 – OPEX Recapitulation (in million rupiah)

Operational Expenses	in million											
	2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Cost of Goods Sold	Rp -	Rp -	Rp 1.858	Rp 12.785	Rp 18.300	Rp 22.138	Rp 43.913	Rp 46.449	Rp 35.251	Rp 30.134	Rp 26.956	Rp 3.995
G&A Expenses	Rp 202	Rp 1.372	Rp 2.007	Rp 2.574	Rp 4.929	Rp 5.481	Rp 4.275	Rp 3.765	Rp 3.357	Rp 684	Rp -	Rp -
Marketing Expenses	Rp 202	Rp 1.372	Rp 2.007	Rp 2.574	Rp 4.929	Rp 5.481	Rp 4.275	Rp 3.765	Rp 3.357	Rp 684	Rp -	Rp -
Total OPEX/ Year	**Rp 403**	**Rp 2.743**	**Rp 5.873**	**Rp 17.934**	**Rp 28.158**	**Rp 33.100**	**Rp 52.463**	**Rp 53.978**	**Rp 41.965**	**Rp 31.502**	**Rp 26.956**	**Rp 3.995**

Location 4 – Debt Schedule (in million rupiah)

Debt Schedule	2020	2021	2022	2023	2024	2025	2026	2027	2028
Loan Initial Balance	Rp -	Rp 7.500	Rp 13.426	Rp 14.067	Rp 11.381	Rp 8.268	Rp 5.155	Rp 2.041	Rp 428
Loan Drawdown	Rp 7.500	Rp 5.926	Rp 2.140	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -

Debt Schedule	2020	2021	2022	2023	2024	2025	2026	2027	2028
Installment 1	Rp -	Rp -	Rp 1.500	Rp 1.500	Rp 1.500	Rp 1.500	Rp 1.500	Rp -	Rp -
Installment 2	Rp -	Rp -	Rp -	Rp 1.185	Rp 1.185	Rp 1.185	Rp 1.185	Rp 1.185	Rp -
Installment 3	Rp -	Rp -	Rp -	Rp -	Rp 428	Rp 428	Rp 428	Rp 428	Rp 428
Loan Balance	Rp 7.500	Rp 13.426	Rp 14.067	Rp 11.381	Rp 8.268	Rp 5.155	Rp 2.041	Rp 428	Rp -

Location 4 – Interest Expense (in million rupiah)

Description	2021	2022	2023	2024	2025	2026	2027	2028
Loan Balance	Rp 13.426	Rp 15.567	Rp 14.067	Rp 11.381	Rp 8.268	Rp 5.155	Rp 2.041	Rp 428
Interest Expense	Rp 1.510	Rp 1.751	Rp 1.582	Rp 1.280	Rp 930	Rp 580	Rp 230	Rp 48

Location 4 – Sales Recapitulation (in million rupiah)

Description		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Number of Houses											
Type 50	64	13	13	13	13	13					
Type 70	263		53	53	53	53	53				
Type 90	98			20	20	20	20	20			

Description		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Type 95	64				13	13	13	13	13		
Type 170	218					44	44	44	44	44	
Type 150	42						8	8	8	8	8
House Price											
Type 50	300.000.000	Rp 315	Rp 331	Rp 347	Rp 365	Rp 383	Rp 402	Rp 422	Rp 443	Rp 465	Rp 489
Type 70	400.000.000	Rp 420	Rp 441	Rp 463	Rp 486	Rp 511	Rp 536	Rp 563	Rp 591	Rp 621	Rp 652
Type 90	500.000.000	Rp 525	Rp 551	Rp 579	Rp 608	Rp 638	Rp 670	Rp 704	Rp 739	Rp 776	Rp 814
Type 95	600.000.000	Rp 630	Rp 662	Rp 695	Rp 729	Rp 766	Rp 804	Rp 844	Rp 886	Rp 931	Rp 977
Type 170	800.000.000	Rp 840	Rp 882	Rp 926	Rp 972	Rp 1.021	Rp 1.072	Rp 1.126	Rp 1.182	Rp 1.241	Rp 1.303
Type 150	1.000.000.000	Rp 1.050	Rp 1.103	Rp 1.158	Rp 1.216	Rp 1.276	Rp 1.340	Rp 1.407	Rp 1.477	Rp 1.551	Rp 1.629
Sales Revenue											

Description	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Type 50	Rp 4.032	Rp 4.234	Rp 4.445	Rp 4.668	Rp 4.901	Rp -	Rp -	Rp -	Rp -	Rp -
Type 70	Rp -	Rp 23.197	Rp 24.356	Rp 25.574	Rp 26.853	Rp 28.196	Rp -	Rp -	Rp -	Rp -
Type 90	Rp -	Rp -	Rp 11.345	Rp 11.912	Rp 12.508	Rp 13.133	Rp 13.790	Rp -	Rp -	Rp -
Type 95	Rp -	Rp -	Rp -	Rp 9.335	Rp 9.802	Rp 10.292	Rp 10.807	Rp 11.347	Rp -	Rp -
Type 170	Rp -	Rp -	Rp -	Rp -	Rp 44.517	Rp 46.743	Rp 49.080	Rp 51.534	Rp 54.110	Rp -
Type 150	Rp -	Rp -	Rp -	Rp -	Rp -	Rp 11.257	Rp 11.820	Rp 12.411	Rp 13.031	Rp 13.683
TOTAL REVENUE	**Rp 4.032**	**Rp 27.430**	**Rp 40.146**	**Rp 51.489**	**Rp 98.580**	**Rp 109.620**	**Rp 85.495**	**Rp 75.291**	**Rp 67.141**	**Rp 13.683**

Location 4 – Sales Advances (in million rupiah)

Account	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Initial Balance of Sales Advances	Rp -	Rp 4.032	Rp 31.462	Rp 67.153	Rp 88.551	Rp 144.502	Rp 201.177	Rp 184.531	Rp 149.697	Rp 132.347	Rp 74.077	Rp 12.440
Sales Advances	Rp 4.032	Rp 27.430	Rp 40.146	Rp 51.489	Rp 98.580	Rp 109.620	Rp 85.495	Rp 75.291	Rp 67.141	Rp 13.683	Rp -	Rp -
Income Recognition	Rp -	Rp -	Rp 4.456	Rp 30.091	Rp 42.628	Rp 52.945	Rp 102.141	Rp 110.126	Rp 84.491	Rp 71.953	Rp 61.637	Rp 12.440
Ending Balance of	Rp 4.032	Rp 31.462	Rp 67.153	Rp 88.551	Rp 144.502	Rp 201.177	Rp 184.531	Rp 149.697	Rp 132.347	Rp 74.077	Rp 12.440	Rp -

Account	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Sales Advances												

Location 4 – Prepaid Expenses (in million rupiah)

PREPAID EXPENSES	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Construction Progress			3%	7%	10%	13%	17%	17%	13%	10%	7%	3%
Operational Expenses												
Initial Balance of Prepaid Expenses	Rp -	Rp 403	Rp 3.146	Rp 5.251	Rp 6.581	Rp 10.710	Rp 14.033	Rp 13.034	Rp 11.015	Rp 10.090	Rp 5.729	Rp 1.910
Prepaid Expenses	Rp 403	Rp 2.743	Rp 4.015	Rp 5.149	Rp 9.858	Rp 10.962	Rp 8.550	Rp 7.529	Rp 6.714	Rp 1.368	Rp -	Rp -
G&A Expense Recognition	Rp -	Rp -	Rp 955	Rp 1.910	Rp 2.865	Rp 3.819	Rp 4.774	Rp 4.774	Rp 3.819	Rp 2.865	Rp 1.910	Rp 955
Marketing Expense Recognition	Rp -	Rp -	Rp 955	Rp 1.910	Rp 2.865	Rp 3.819	Rp 4.774	Rp 4.774	Rp 3.819	Rp 2.865	Rp 1.910	Rp 955
Ending Balance of Prepaid Expense	Rp 403	Rp 3.146	Rp 5.251	Rp 6.581	Rp 10.710	Rp 14.033	Rp 13.034	Rp 11.015	Rp 10.090	Rp 5.729	Rp 1.910	Rp 0
Interest Expenses												

PREPAID EXPENSES	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Initial Balance of Prepaid Expenses	Rp -	Rp 1.510	Rp 3.262	Rp 4.580	Rp 5.333	Rp 5.472	Rp 4.997	Rp 3.908	Rp 2.637	Rp 1.582	Rp 791	Rp 264
Prepaid interest expenses	Rp 1.510	Rp 1.751	Rp 1.582	Rp 1.280	Rp 930	Rp 580	Rp 230	Rp 48	Rp -	Rp -	Rp -	Rp -
Interest Expenses Recognition	Rp -	Rp -	Rp 264	Rp 527	Rp 791	Rp 1.055	Rp 1.319	Rp 1.319	Rp 1.055	Rp 791	Rp 527	Rp 264
Ending Balance of Prepaid Expenses	Rp 1.510	Rp 3.262	Rp 4.580	Rp 5.333	Rp 5.472	Rp 4.997	Rp 3.908	Rp 2.637	Rp 1.582	Rp 791	Rp 264	Rp -
Total Prepaid Expenses	**Rp 1.914**	**Rp 6.408**	**Rp 9.832**	**Rp 11.914**	**Rp 16.182**	**Rp 19.030**	**Rp 16.942**	**Rp 13.652**	**Rp 11.672**	**Rp 6.520**	**Rp 2.173**	**Rp -**

Location 4 – Income Statement (in million rupiah)

Description	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Revenue	**4.456**	**30.091**	**42.628**	**52.945**	**102.141**	**110.126**	**84.491**	**71.953**	**61.637**	**12.440**
Cost of Goods Sold	(1.973)	(13.532)	(19.282)	(23.120)	(44.895)	(47.315)	(35.486)	(30.134)	(26.956)	(3.995)
Gross Profit	**2.483**	**16.559**	**23.346**	**29.825**	**57.247**	**62.810**	**49.005**	**41.820**	**34.680**	**8.445**
Operating Expenses										

Description	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Marketing Expenses	(955)	(1.910)	(2.865)	(3.819)	(4.774)	(4.774)	(3.819)	(2.865)	(1.910)	(955)
General & Administrative Expenses	(955)	(1.910)	(2.865)	(3.819)	(4.774)	(4.774)	(3.819)	(2.865)	(1.910)	(955)
Total Operating Expenses	**(1.910)**	**(3.819)**	**(5.729)**	**(7.639)**	**(9.548)**	**(9.548)**	**(7.639)**	**(5.729)**	**(3.819)**	**(1.910)**
Operating Profit (EBIT)	**573**	**12.740**	**17.617**	**22.186**	**47.698**	**53.262**	**41.366**	**36.091**	**30.861**	**6.536**
Other Revenue & Expenses										
Interest expenses	(264)	(527)	(791)	(1.055)	(1.319)	(1.319)	(1.055)	(791)	(527)	(264)
Total Other Revenue & Expenses	**(264)**	**(527)**	**(791)**	**(1.055)**	**(1.319)**	**(1.319)**	**(1.055)**	**(791)**	**(527)**	**(264)**
Earning Before Tax (EBT)	**309**	**12.212**	**16.826**	**21.131**	**46.379**	**51.943**	**40.311**	**35.299**	**30.334**	**6.272**
Tax	(8)	(305)	(421)	(528)	(1.159)	(1.299)	(1.008)	(882)	(758)	(157)
Earning After Tax (EAT)	**301**	**11.907**	**16.405**	**20.603**	**45.220**	**50.644**	**39.303**	**34.417**	**29.575**	**6.115**

Location 4 – Cash Flow Statement (in million rupiah)

DESCRIPTIONS	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032

DESCRIPTIONS	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Operational Cash Flow												
Cash received from sales	4.032	27.430	40.146	51.489	98.580	109.620	85.495	75.291	67.141	13.683		
Cost of goods sold			(1.858)	(12.785)	(18.300)	(22.138)	(43.913)	(46.449)	(35.251)	(30.134)	(26.956)	(3.995)
Landbank Acquisition	(25.000)											
G & A Expenditure	(202)	(1.372)	(2.007)	(2.574)	(4.929)	(5.481)	(4.275)	(3.765)	(3.357)	(684)		
Marketing Expenditure	(202)	(1.372)	(2.007)	(2.574)	(4.929)	(5.481)	(4.275)	(3.765)	(3.357)	(684)		
Other income												
Other expenses												
Interest payment	(1.510)	(1.751)	(1.582)	(1.280)	(930)	(580)	(230)	(48)				
Tax payment			(8)	(305)	(421)	(528)	(1.159)	(1.299)	(1.008)	(882)	(758)	(157)
Total Operational Cash Flow	**(22.882)**	**22.936**	**32.684**	**31.969**	**69.071**	**75.411**	**31.643**	**19.966**	**24.169**	**(18.702)**	**(27.715)**	**(4.152)**
Investment Cash Flow												
Infrastructures	(3.383)	(3.383)										
Facilities	(3.587)	(3.587)										
Utilities	(164)	(164)										
Land Cut and Fill	(12.621)											
Total Investment Cash Flow	**(19.755)**	**(7.134)**										

DESCRIPTIONS	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Financing Cash Flow												
Loan Drawdown	13.426	2.140										
Loan Installment			(1.185)	(1.613)	(1.613)	(1.613)	(1.613)	(428)				
Owner's Funding	31.328	4.994										
Landbank Loan Installment		(1.500)	(1.500)	(1.500)	(1.500)	(1.500)						
Total Financing Cash Flow	**44.755**	**5.634**	**(2.685)**	**(3.113)**	**(3.113)**	**(3.113)**	**(1.613)**	**(428)**				
Net Cash Flow	**2.118**	**21.436**	**29.998**	**28.855**	**65.957**	**72.298**	**30.030**	**19.538**	**24.169**	**(18.702)**	**(27.715)**	**(4.152)**
Beginning Cash Balance		**2.118**	**23.554**	**53.552**	**82.408**	**148.365**	**220.663**	**250.693**	**270.232**	**294.401**	**275.699**	**247.984**
Ending Cash Balance	**2.118**	**23.554**	**53.552**	**82.408**	**148.365**	**220.663**	**250.693**	**270.232**	**294.401**	**275.699**	**247.984**	**243.833**

Location 4 – Balance Sheet (in million rupiah)

DESCRIPTIONS	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
ASSETS												
CURRENT ASSETS												
Cash	2.118	23.554	53.552	82.408	148.365	220.663	250.693	270.232	294.401	275.699	247.984	243.833
Land Bank	25.000	25.000	24.885	24.138	23.157	22.175	21.194	20.327	20.092	20.092	20.092	20.092
Prepaid Expenses	1.914	6.408	9.832	11.914	16.182	19.030	16.942	13.652	11.672	6.520	2.173	
TOTAL CURRENT ASSETS	**29.032**	**54.962**	**88.269**	**118.460**	**187.704**	**261.868**	**288.829**	**304.211**	**326.165**	**302.311**	**270.250**	**263.925**
FIXED ASSETS												
Existing fixed assets		19.755	26.889	26.889	26.889	26.889	26.889	26.889	26.889	26.889	26.889	26.889
New Fixed Assets	19.755	7.134										
Fixed Assets	19.755	26.889	26.889	26.889	26.889	26.889	26.889	26.889	26.889	26.889	26.889	26.889
Net Fixed Assets	19.755	26.889	26.889	26.889	26.889	26.889	26.889	26.889	26.889	26.889	26.889	26.889
TOTAL FIXED ASSETS	**19.755**	**26.889**	**26.889**	**26.889**	**26.889**	**26.889**	**26.889**	**26.889**	**26.889**	**26.889**	**26.889**	**26.889**
TOTAL ASSETS	**48.787**	**81.851**	**115.158**	**145.349**	**214.593**	**288.757**	**315.718**	**331.100**	**353.054**	**329.200**	**297.139**	**290.813**
LIABILITIES												
CURRENT LIABILITIES												
Sales Advances	4.032	31.462	67.153	88.551	144.502	201.177	184.531	149.697	132.347	74.077	12.440	
TOTAL CURRENT LIABILITIES	**4.032**	**31.462**	**67.153**	**88.551**	**144.502**	**201.177**	**184.531**	**149.697**	**132.347**	**74.077**	**12.440**	
LONG TERM LIABILITIES												

Long Term Debt	5.926	8.067	6.881	5.268	3.655	2.041	428					
Debt Land Acquisition	7.500	6.000	4.500	3.000	1.500							
TOTAL LONG TERM LIABILITIES	**13.426**	**14.067**	**11.381**	**8.268**	**5.155**	**2.041**	**428**					
EQUITY												
Paid-Up Capital	31.328	4.994										
Capital	31.328	36.322	36.322	36.322	36.322	36.322	36.322	36.322	36.322	36.322	36.322	36.322
Profit This Year			301	11.907	16.405	20.603	45.220	50.644	39.303	34.417	29.575	6.115
Retained Earnings			301	12.208	28.614	49.217	94.436	145.081	184.384	218.801	248.376	254.491
TOTAL EQUITY	**31.328**	**36.322**	**36.624**	**48.531**	**64.936**	**85.539**	**130.759**	**181.403**	**220.706**	**255.123**	**284.698**	**290.813**
TOTAL EQUITY & LIABILITIES	**48.787**	**81.851**	**115.158**	**145.349**	**214.593**	**288.757**	**315.718**	**331.100**	**353.054**	**329.200**	**297.139**	**290.813**

Location 4 – Free Cash Flow (in million rupiah)

FREE CASH FLOW	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Operational Cash Flow												
Cash received from sales	4.032	27.430	40.146	51.489	98.580	109.620	85.495	75.291	67.141	13.683		
Cost of goods payment			(1.858)	(12.785)	(18.300)	(22.138)	(43.913)	(46.449)	(35.251)	(30.134)	(26.956)	(3.995)
Landbank Purchasing	(25.000)											
G & A Expenditure	(202)	(1.372)	(2.007)	(2.574)	(4.929)	(5.481)	(4.275)	(3.765)	(3.357)	(684)		
Marketing Expenditure	(202)	(1.372)	(2.007)	(2.574)	(4.929)	(5.481)	(4.275)	(3.765)	(3.357)	(684)		

FREE CASH FLOW	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Operational Cash Flow	**(21.371)**	**24.687**	**34.266**	**33.555**	**70.422**	**76.519**	**33.033**	**21.313**	**25.177**	**(17.819)**	**(26.956)**	**(3.995)**
Investment Cash Flow												
Infrastructures	(3.383)	(3.383)										
Facilities	(3.587)	(3.587)										
Utilities	(164)	(164)										
Land Cut and Fill	(12.621)											
Total Investment Cash Flow	**(19.755)**	**(7.134)**										
FREE CASH FLOW	**(41.126)**	**17.553**	**34.266**	**33.555**	**70.422**	**76.519**	**33.033**	**21.313**	**25.177**	**(17.819)**	**(26.956)**	**(3.995)**

Attachment 2 Location 2 Detailed Financial Modelling

Location 2 – OPEX Recapitulation (in million rupiah)

OPEX	in million									
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cost of Goods Sold	Rp -	Rp -	Rp 15.194	Rp 15.542	Rp 19.317	Rp 23.063	Rp 23.594	Rp 7.114	Rp 7.279	Rp 3.611
G&A Expenses	Rp 3.175	Rp 3.334	Rp 4.147	Rp 4.937	Rp 5.184	Rp 1.391	Rp 1.461	Rp 709	Rp -	Rp -
Marketing Expenses	Rp 3.175	Rp 3.334	Rp 4.147	Rp 4.937	Rp 5.184	Rp 1.391	Rp 1.461	Rp 709	Rp -	Rp -
Total OPEX/Year	**Rp 6.350**	**Rp 6.668**	**Rp 23.488**	**Rp 25.417**	**Rp 29.686**	**Rp 25.845**	**Rp 26.516**	**Rp 8.532**	**Rp 7.279**	**Rp 3.611**

Location 2 – Debt Repayment Schedule (in million rupiah)

Debt Schedule	2020	2021	2022	2023	2024	2025	2026	2027	2028
Loan Initial Balance	Rp -	Rp 45.750	Rp 60.379	Rp 56.632	Rp 44.556	Rp 31.400	Rp 18.243	Rp 5.087	Rp 1.081
Loan Drawdown	Rp 45.750	Rp 14.629	Rp 5.403	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -
Installment 1	Rp -	Rp -	Rp 9.150	Rp 9.150	Rp 9.150	Rp 9.150	Rp 9.150	Rp -	Rp -
Installment 2	Rp -	Rp -	Rp -	Rp 2.926	Rp 2.926	Rp 2.926	Rp 2.926	Rp 2.926	Rp -

Debt Schedule	2020	2021	2022	2023	2024	2025	2026	2027	2028
Installment 3	Rp -	Rp -	Rp -	Rp -	Rp 1.081	Rp 1.081	Rp 1.081	Rp 1.081	Rp 1.081
Loan Balance	Rp 45.750	Rp 60.379	Rp 56.632	Rp 44.556	Rp 31.400	Rp 18.243	Rp 5.087	Rp 1.081	Rp -

Location 2 – Interest Expense (in million rupiah)

Description	2021	2022	2023	2024	2025	2026	2027	2028
Loan Balance	Rp 60.379	Rp 65.782	Rp 56.632	Rp 44.556	Rp 31.400	Rp 18.243	Rp 5.087	Rp 1.081
Interest Expense	Rp 6.793	Rp 7.400	Rp 6.371	Rp 5.013	Rp 3.532	Rp 2.052	Rp 572	Rp 122

Location 2 – Sales Recapitulation (in million rupiah)

Description		2021	2022	2023	2024	2025	2026	2027	2028
Number of Houses									
Type 36	720	144	144	144	144	144			
Type 45	124			25	25	25	25	25	
Type 55	96				19	19	19	19	19
House Price									
Type 36	420.000.000	Rp 441	Rp 463	Rp 486	Rp 511	Rp 536	Rp 563	Rp 591	Rp 621

Description		2021	2022	2023	2024	2025	2026	2027	2028
Type 45	450.000.000	Rp 473	Rp 496	Rp 521	Rp 547	Rp 574	Rp 603	Rp 633	Rp 665
Type 55	500.000.000	Rp 525	Rp 551	Rp 579	Rp 608	Rp 638	Rp 670	Rp 704	Rp 739
Sales Revenue									
Type 36		Rp 63.504	Rp 66.679	Rp 70.013	Rp 73.514	Rp 77.190			
Type 45				Rp 12.919	Rp 13.565	Rp 14.243	Rp 14.955	Rp 15.703	
Type 55					Rp 11.669	Rp 12.252	Rp 12.865	Rp 13.508	Rp 14.184
TOTAL REVENUE		**Rp 63.504**	**Rp 66.679**	**Rp 82.932**	**Rp 98.748**	**Rp 103.685**	**Rp 27.820**	**Rp 29.211**	**Rp 14.184**

Location 2 – Sales Advances (in million rupiah)

Account	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Initial Balance of Sales Advances	Rp -	Rp 63.504	Rp 130.183	Rp 142.936	Rp 171.503	Rp 190.731	Rp 121.199	Rp 53.058	Rp 40.068	Rp 12.896
Sales Advances	Rp 63.504	Rp 66.679	Rp 82.932	Rp 98.748	Rp 103.685	Rp 27.820	Rp 29.211	Rp 14.184	Rp -	Rp -
Income Recognition	Rp -	Rp -	Rp 70.180	Rp 70.180	Rp 84.457	Rp 97.353	Rp 97.353	Rp 27.173	Rp 27.173	Rp 12.896
Ending Balance of	Rp 63.504	Rp 130.183	Rp 142.936	Rp 171.503	Rp 190.731	Rp 121.199	Rp 53.058	Rp 40.068	Rp 12.896	Rp -

Account	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Sales Advances										

Location 2 – Prepaid Expenses (in million rupiah)

PREPAID EXPENSES	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Construction Progress			7%	7%	13%	20%	20%	13%	13%	7%
Operational Expenses										
Initial Balance of Prepaid Expenses	Rp -	Rp 6.350	Rp 13.018	Rp 18.066	Rp 24.696	Rp 28.574	Rp 21.621	Rp 14.807	Rp 9.735	Rp 3.245
Prepaid Expenses	Rp 6.350	Rp 6.668	Rp 8.293	Rp 9.875	Rp 10.369	Rp 2.782	Rp 2.921	Rp 1.418	Rp -	Rp -
G&A Expense Recognition	Rp -	Rp -	Rp 1.623	Rp 1.623	Rp 3.245	Rp 4.868	Rp 4.868	Rp 3.245	Rp 3.245	Rp 1.623
Marketing Expense Recognition	Rp -	Rp -	Rp 1.623	Rp 1.623	Rp 3.245	Rp 4.868	Rp 4.868	Rp 3.245	Rp 3.245	Rp 1.623
Ending Balance of Prepaid Expense	Rp 6.350	Rp 13.018	Rp 18.066	Rp 24.696	Rp 28.574	Rp 21.621	Rp 14.807	Rp 9.735	Rp 3.245	Rp -
Interest Expenses										
Initial Balance of Prepaid Expenses	Rp -	Rp 6.793	Rp 14.193	Rp 18.440	Rp 21.329	Rp 20.614	Rp 16.296	Rp 10.497	Rp 6.371	Rp 2.124
Prepaid interest expenses	Rp 6.793	Rp 7.400	Rp 6.371	Rp 5.013	Rp 3.532	Rp 2.052	Rp 572	Rp 122	Rp -	Rp -

PREPAID EXPENSES	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Interest Expenses Recognition	Rp -	Rp -	Rp 2.124	Rp 2.124	Rp 4.247	Rp 6.371	Rp 6.371	Rp 4.247	Rp 4.247	Rp 2.124
Ending Balance of Prepaid Expenses	Rp 6.793	Rp 14.193	Rp 18.440	Rp 21.329	Rp 20.614	Rp 16.296	Rp 10.497	Rp 6.371	Rp 2.124	Rp -
Total Prepaid Expenses	**Rp 13.143**	**Rp 27.211**	**Rp 36.507**	**Rp 46.025**	**Rp 49.189**	**Rp 37.917**	**Rp 25.304**	**Rp 16.106**	**Rp 5.369**	**Rp -**

Location 2 – Income Statement (in million rupiah)

Description	2023	2024	2025	2026	2027	2028	2029	2030
Revenue	**70.180**	**70.180**	**84.457**	**97.353**	**97.353**	**27.173**	**27.173**	**12.896**
Cost of Goods Sold	(17.786)	(18.134)	(22.467)	(26.717)	(27.248)	(8.176)	(8.341)	(4.115)
Gross Profit	**52.394**	**52.046**	**61.990**	**70.635**	**70.104**	**18.997**	**18.831**	**8.780**
Operating Expenses								
Marketing Expenses	(1.623)	(1.623)	(3.245)	(4.868)	(4.868)	(3.245)	(3.245)	(1.623)
General & Administrative Expenses	(1.623)	(1.623)	(3.245)	(4.868)	(4.868)	(3.245)	(3.245)	(1.623)
Total Operating Expenses	**(3.245)**	**(3.245)**	**(6.490)**	**(9.735)**	**(9.735)**	**(6.490)**	**(6.490)**	**(3.245)**
Operating Profit (EBIT)	**49.148**	**48.801**	**55.500**	**60.900**	**60.369**	**12.507**	**12.341**	**5.535**

Description	2023	2024	2025	2026	2027	2028	2029	2030
Other Revenue & Expenses								
Interest expenses	(2.124)	(2.124)	(4.247)	(6.371)	(6.371)	(4.247)	(4.247)	(2.124)
Total Other Revenue & Expenses	**(2.124)**	**(2.124)**	**(4.247)**	**(6.371)**	**(6.371)**	**(4.247)**	**(4.247)**	**(2.124)**
Earning Before Tax (EBT)	**47.025**	**46.677**	**51.253**	**54.529**	**53.998**	**8.259**	**8.094**	**3.412**
Tax	(1.176)	(1.167)	(1.281)	(1.363)	(1.350)	(206)	(202)	(85)
Earning After Tax (EAT)	**45.849**	**45.510**	**49.971**	**53.166**	**52.648**	**8.053**	**7.891**	**3.326**

Location 2 – Cash Flow Statement

DESCRIPTIONS	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Operational Cash Flow										
Cash received from sales	63.504	66.679	82.932	98.748	103.685	27.820	29.211	14.184		
Cost of goods sold			(15.194)	(15.542)	(19.317)	(23.063)	(23.594)	(7.114)	(7.279)	(3.611)
Landbank Acquisition	(152.500)									
G & A Expenditure	(3.175)	(3.334)	(4.147)	(4.937)	(5.184)	(1.391)	(1.461)	(709)		
Marketing Expenditure	(3.175)	(3.334)	(4.147)	(4.937)	(5.184)	(1.391)	(1.461)	(709)		
Other income										
Other expenses										
Interest payment	(6.793)	(7.400)	(6.371)	(5.013)	(3.532)	(2.052)	(572)	(122)		

DESCRIPTIONS	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Tax payment			(1.176)	(1.167)	(1.281)	(1.363)	(1.350)	(206)	(202)	(85)
Total Operational Cash Flow	**(102.139)**	**52.611**	**51.898**	**67.151**	**69.186**	**(1.441)**	**774**	**5.323**	**(7.482)**	**(3.697)**
Investment Cash Flow										
Infrastructures	(7.554)	(7.554)								
Facilities	(10.119)	(10.119)								
Utilities	(336)	(336)								
Land Cut and Fill	(30.754)									
Total Investment Cash Flow	**(48.763)**	**(18.009)**								
Financing Cash Flow										
Loan Drawdown	60.379	5.403								
Loan Installment			(2.926)	(4.006)	(4.006)	(4.006)	(4.006)	(1.081)		
Owner's Funding	140.884	12.607								
Landbank Loan Installment		(9.150)	(9.150)	(9.150)	(9.150)	(9.150)				
Total Financing Cash Flow	**201.263**	**8.859**	**(12.076)**	**(13.156)**	**(13.156)**	**(13.156)**	**(4.006)**	**(1.081)**		
Net Cash Flow	**50.361**	**43.461**	**39.822**	**53.995**	**56.029**	**(14.597)**	**(3.233)**	**4.243**	**(7.482)**	**(3.697)**
Beginning Cash Balance		**50.361**	**93.822**	**133.644**	**187.639**	**243.669**	**229.072**	**225.839**	**230.081**	**222.600**
Ending Cash Balance	**50.361**	**93.822**	**133.644**	**187.639**	**243.669**	**229.072**	**225.839**	**230.081**	**222.600**	**218.903**

Location 2 – Balance Sheet (in million rupiah)

DESCRIPTIONS	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
ASSETS										
CURRENT ASSETS										
Cash	50.361	93.822	133.644	187.639	243.669	229.072	225.839	230.081	222.600	218.903
Land Bank	152.500	152.500	149.908	147.316	144.166	140.512	136.858	135.796	134.734	134.230
Prepaid Expenses	13.143	27.211	36.507	46.025	49.189	37.917	25.304	16.106	5.369	0
TOTAL CURRENT ASSETS	**216.004**	**273.533**	**320.059**	**380.981**	**437.023**	**407.501**	**388.001**	**381.984**	**362.702**	**353.133**
FIXED ASSETS										
Existing fixed assets		48.763	66.772	66.772	66.772	66.772	66.772	66.772	66.772	66.772
New Fixed Assets	48.763	18.009								
Fixed Assets	48.763	66.772	66.772	66.772	66.772	66.772	66.772	66.772	66.772	66.772
Net Fixed Assets	48.763	66.772	66.772	66.772	66.772	66.772	66.772	66.772	66.772	66.772
TOTAL FIXED ASSETS	**48.763**	**66.772**	**66.772**	**66.772**	**66.772**	**66.772**	**66.772**	**66.772**	**66.772**	**66.772**
TOTAL ASSETS	**264.767**	**340.306**	**386.831**	**447.753**	**503.796**	**474.273**	**454.773**	**448.756**	**429.475**	**419.905**
LIABILITIES										
CURRENT LIABILITIES										
Sales Advances	63.504	130.183	142.936	171.503	190.731	121.199	53.058	40.068	12.896	
TOTAL CURRENT LIABILITIES	**63.504**	**130.183**	**142.936**	**171.503**	**190.731**	**121.199**	**53.058**	**40.068**	**12.896**	

DESCRIPTIONS	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
LONG TERM LIABILITIES										
Long Term Debt	14.629	20.032	17.106	13.100	9.093	5.087	1.081			
Debt Land Acquisition	45.750	36.600	27.450	18.300	9.150					
TOTAL LONG TERM LIABILITIES	**60.379**	**56.632**	**44.556**	**31.400**	**18.243**	**5.087**	**1.081**			
EQUITY										
Paid-Up Capital	140.884	12.607								
Capital	140.884	153.491	153.491	153.491	153.491	153.491	153.491	153.491	153.491	153.491
Profit This Year			45.849	45.510	49.971	53.166	52.648	8.053	7.891	3.326
Retained Earnings			45.849	91.359	141.331	194.496	247.144	255.197	263.089	266.415
TOTAL EQUITY	**140.884**	**153.491**	**199.340**	**244.850**	**294.821**	**347.987**	**400.635**	**408.688**	**416.579**	**419.905**
TOTAL EQUITY & LIABILITIES	**264.767**	**340.306**	**386.831**	**447.753**	**503.796**	**474.273**	**454.773**	**448.756**	**429.475**	**419.905**

Location 2 – Free Cash Flow (in million rupiah)

FREE CASH FLOW	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Operational Cash Flow										
Cash received from sales	63.504	66.679	82.932	98.748	103.685	27.820	29.211	14.184		
Cost of goods payment			(15.194)	(15.542)	(19.317)	(23.063)	(23.594)	(7.114)	(7.279)	(3.611)
Landbank Purchasing	(152.500)									

FREE CASH FLOW	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
G & A Expenditure	(3.175)	(3.334)	(4.147)	(4.937)	(5.184)	(1.391)	(1.461)	(709)		
Marketing Expenditure	(3.175)	(3.334)	(4.147)	(4.937)	(5.184)	(1.391)	(1.461)	(709)		
Total Operational Cash Flow	**(95.346)**	**60.011**	**59.445**	**73.331**	**74.000**	**1.975**	**2.696**	**5.651**	**(7.279)**	**(3.611)**
Investment Cash Flow										
Infrastructures	(7.554)	(7.554)								
Facilities	(10.119)	(10.119)								
Utilities	(336)	(336)								
Land Cut and Fill	(30.754)									
Total Investment Cash Flow	**(48.763)**	**(18.009)**								
FREE CASH FLOW	**(144.109)**	**42.002**	**59.445**	**73.331**	**74.000**	**1.975**	**2.696**	**5.651**	**(7.279)**	**(3.611)**

AUTHOR'S BIOGRAPHY

Author, named Muhammad Alam Pradipta, was born in Malang, 19th of May 1999. Author is the last child of two siblings. Author formal education background started from MIN Malang 1, SMP Negeri 1 Malang, SMA Negeri 3 Malang, up to this point, where the author able to finished author's Undergraduate (S1) Degree in Department of Industrial System and Engineering of Institut Teknologi Sepuluh Nopember (ITS). During author's study in Department of Industrial System and Engineering of ITS, author has contributed to several organization and committee. Author has contributed as a Volleyball Manager of UMTI Sportclub in 2018/2019, Chairman of UMTI Sportclub in 2019/2020, and Laboratory Assistant of Laboratorium Perancangan Sistem dan Manajemen Industri (PSMI) ITS from 2019 until 2021. As a Laboratory Assistant in PSMI Laboratory, author had the opportunity to implement knowledge and skills especially from PSMI Laboratory in campus academic activities such as assisting lecturers in conducting courses, teaching and assisting fellow students. Author can be reached via email at alampradiptaa@gmail.com